

digital

USER GUIDE

VT100

digital

Planned
R.C

VT100 USER GUIDE

1st Edition, August 1978
2nd Edition, January 1979
3rd Edition, June 1981

Copyright © 1978, 1979, 1981 by
Digital Equipment Corporation

The material in this manual is for informational
purposes and is subject to change without notice.

Digital Equipment Corporation assumes no re-
sponsibility for any errors which may appear in
this manual.

Printed in U.S.A.

This document was set on DIGITAL's DECset-
8000 computerized typesetting system.

The following are trademarks of Digital Equip-
ment Corporation, Maynard, Massachusetts:

DIGITAL	DECsystem-10	MASSBUS
DEC	DECSYSTEM-20	OMNIBUS
PDP	DIBOL	OS/8
DECUS	EDUSYSTEM	RSTS
UNIBUS	VAX	RSX
	VMS	IAS

CONTENTS

INTRODUCTION

CHAPTER 1 OPERATOR INFORMATION

PART 1 – KEYBOARD CONTROLS AND INDICATORS	4
Monitor Controls	7
Audible Indicators (Tones)	7
PART 2 – SET-UP MODE	8
SET-UP Features at a Glance	8
Determining What a SET-UP Feature Does	10
How To Change a SET-UP Feature	11
Setting the Answerback Message	12
Saving the SET-UP Features	12
Recalling SET-UP Features	12
Resetting the Terminal	13
PART 3 – DEFINITION OF EACH SET-UP FEATURE	13
PART 4 – SELF-TESTING THE VT100	16
Self-Test Error Codes	17
PART 5 – WHAT TO DO IN THE EVENT OF A PROBLEM	18

CHAPTER 2 INSTALLATION, INTERFACE INFORMATION AND SPECIFICATIONS

Installation	21
Site Considerations	21
Unpacking and Installation	21
User Maintenance	24
Interface Information	24
EIA Interface	24
Optional 20 mA Current Loop Interface	26
External Video Connections	27
VT100 Specifications	28
How to Order Hardware Documentation	30

CHAPTER 3 PROGRAMMER SECTION

The Keyboard	34
Communications Protocols	40
Terminal Control Commands	42
Control Characters	42
Control Sequences	43
Valid ANSI Mode Control Sequences	43
CPR Cursor Position Report – VT100 to Host	45
CUB Cursor Backward – Host to VT100 and VT100 to Host	45
CUD Cursor Down – Host to VT100 and VT100 to Host	45
CUF Cursor Forward – Host to VT100 and VT100 to Host	45
CUP Cursor Position	45
CUU Cursor Up – Host to VT100 and VT100 to Host	46
DA Device Attributes	46
DECALN Screen Alignment Display (DEC Private)	46
DECANM ANSI/VT52 Mode (DEC Private)	46
DECARM Auto Repeat Mode (DEC Private)	47
DECAWM Autowrap Mode (DEC Private)	47
DECCKM Cursor Keys Mode (DEC Private)	47

DECCOLM Column Mode (DEC Private)	47
DECDHL Double-Height Line (DEC Private)	47
DECDWL Double-Width Line (DEC Private)	47
DECID Identify Terminal (DEC Private)	48
DECINLM Interlace Mode (DEC Private)	48
DECKPAM Keypad Application Mode (DEC Private)	48
DECKPNM Keypad Numeric Mode (DEC Private)	48
DECLL Load LEDS (DEC Private)	48
DECOM Origin Mode (DEC Private)	48
DECRC Restore Cursor (DEC Private)	49
DECREPTPARM Report Terminal Parameters	49
DECREQTPARM Request Terminal Parameters	49
DECSC Save Cursor (DEC Private)	50
DECSCLM Scrolling Mode (DEC Private)	50
DECSCNM Screen Mode (DEC Private)	50
DECSTBM Set Top and Bottom Margins (DEC Private)	50
DECSWLF Single-Width Line (DEC Private)	51
DECTST Invoke Confidence Test	51
DSR Device Status Report	51
ED Erase In Display	52
EL Erase In Line	52
HTS Horizontal Tabulation Set	52
HVP Horizontal and Vertical Position	52
IND Index	53
LNM Line-Feed/New Line Mode	53
NEL Next Line	53
RI Reverse Index	53
RIS Reset To Initial State	53
RM Reset Mode	53
SCS Select Character Set	54
SGR Select Graphic Rendition	54
SM Set Mode	54
TBC Tabulation Clear	55
Modes	55
ANSI Specified Modes	55
DEC Private Modes	55
Valid VT52 Mode Control Sequences	56
Cursor Up	56
Cursor Down	56
Cursor Right	56
Cursor Left	56
Enter Graphics Mode	56
Exit Graphics Mode	57
Cursor to Home	57
Reverse Line Feed	57
Erase to End of Screen	57
Erase to End of Line	57
Direct Cursor Address	57
Identify	57
Enter Alternate Keypad Mode	57
Exit Alternate Keypad Mode	58
Enter ANSI Mode	58
Control Sequence Summary	58

ANSI Compatible Mode	58
VT52 Compatible Mode	61

CHAPTER 4 VT100 OPTIONS

Advanced Video Option – VT1XX-AB.....	65
Advanced Video Option Installation.....	66
Advanced Video Option Checkout.....	66
20 mA Current Loop Option – VT1XX-AA.....	68
20 mA Current Loop Option Installation	68
20 mA Current Loop Option Checkout	69
Communications Cables.....	70

CHAPTER 5 ACCESSORIES AND SUPPLIES

APPENDIX A ANSI DEFINITIONS AND NOTATION

APPENDIX B 7-BIT ASCII CODE

APPENDIX C FILL CHARACTER REQUIREMENTS

FIGURES

1-1 VT100 Terminal.....	2
1-2 VT100 Keyboard	4
1-3 VT100 Terminal (Rear View).....	7
1-4 SET-UP A Mode Presentation	8
1-5 SET-UP B Mode Presentation	9
1-6 SET-UP B Mode Summary	9
2-1 VT100 Terminal Dimensions.....	22
2-2 VT100 Rear View	23
2-3 20 mA Current Loop Interface	26
2-4 Composite Video Output.....	28
3-1 Terminal Data Flow	33
3-2 VT100 Keyboard.....	34
4-1 VT100 Rear View	67
4-2 Advanced Video Option Installation	67
4-3 20 mA Current Loop Option	68
4-4 Terminal Controller Board	69

TABLES

1-1 Categories of SET-UP Features.....	10
1-2 SET-UP Feature Change Summary	11
1-3 Nonfatal Displayed Error Codes	17
1-4 Problem Checklist	18
2-1 EIA RS-232-C Connector Signals	24
3-1 Machine States	35
3-2 Alphabetic Key Codes	35
3-3 Nonalphabetic Key Codes	36
3-4 Function Key Codes	36
3-5 Control Codes Generated	37
3-6 Cursor Control Key Codes	38

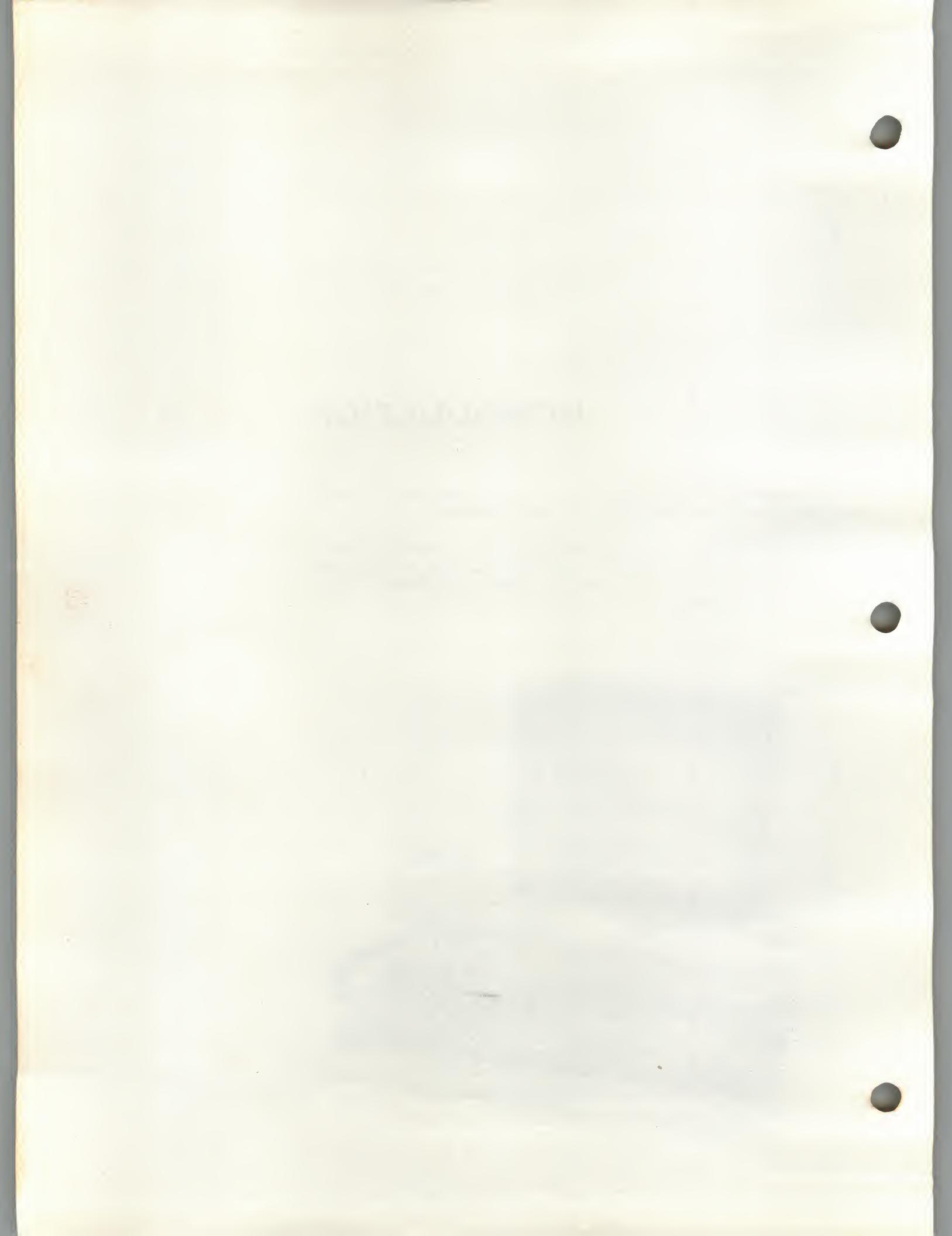
3-7	VT52 Mode Auxiliary Keypad Codes.....	38
3-8	ANSI Mode Auxiliary Keypad Codes.....	39
3-9	Special Graphics Characters.....	39
3-10	Control Characters.....	42
C-1	Fill Character Requirements.....	89

INTRODUCTION

The VT100 terminal is designed to work very much like a typewriter. This guide will tell you everything you need to know to use your terminal.

A checklist label is provided for making a semi-permanent record of the features, unique functions, and mode of operation of your terminal. Place this label under the keyboard and keep it up-to-date so that you will have a quick reference to the basic status of your machine.





Operator Information



Figure 1-1
VT100 Terminal

CHAPTER 1

OPERATOR INFORMATION

The VT100 is a simple device to operate. The terminal (Figure 1-1) is basically a typewriter that uses a video screen instead of paper and communicates with a computer. If you can operate a typewriter, you can operate a VT100.

Chapter 1 is divided into five parts:

1. Controls and Indicators
2. Setup Mode
3. Definition of Each Setup Feature
4. Self-Testing the VT100
5. What to do in the Event of a Problem

Part 1 shows all the controls and indicators on the terminal and summarizes the function of each, thus providing a quick reference for these functions.

Part 2 defines the SET-UP mode and briefly summarizes its features.

Part 3 describes each feature in detail. Refer to this section if you need further information on a feature mentioned in the SET-UP Summary provided in Part 2.

Part 4 provides information on self-testing the VT100. It outlines the steps required to start the built-in self-tests and how to interpret the results once the tests have been run.

Part 5 provides a procedure to follow in case you encounter any problem with the VT100. Easily recognized failures with simple corrective actions are provided for each symptom. Check the list on page 18 before calling for service.

PART 1

KEYBOARD CONTROLS
AND INDICATORS

The VT100 terminal normally performs a two-part function. It is an input device to a computer – information entered through the keyboard is sent to the computer. It is simultaneously an output device for the computer – that is, data coming in from the computer is displayed on the video screen. The following controls and indicators on the VT100 keyboard are illustrated in Figure 1-2.



Figure 1-2 VT100 Keyboard

SETUP

This key is used in conjunction with other keys to perform specific functions such as setting tabs, scrolling, and altering terminal characteristics.

ON LINE

This indicator lights to show that the VT100 is on-line and ready to transmit or receive messages.

LOCAL

This indicator lights to show that the terminal is off-line and cannot communicate with the host device. In local mode the keyboard remains active and all characters typed are placed on the screen.

KEYBOARD LOCKED

This indicator lights to show that the keyboard has been turned off. The VT100 is still able to receive data from the host. This condition can be cleared by entering and exiting SET-UP mode.

L1—L4

These indicators are turned on and off by the host. Consult your local operating procedures for the meaning of each indicator. L1—L4 are also used to show self-test errors.



Each of these keys causes the VT100 to transmit a code which has a special meaning to your system. Consult your local operating procedures for the meaning of these keys. In SET-UP mode the **↑** and **↓** keys increase or decrease the brightness of the display. The **←** and **→** keys move the cursor left and right.



BACKSPACE

This key transmits a backspace code.

BREAK

This key transmits a break signal.

PF1 PF2 PF3 PF4

PF1 – PF4

Each of these keys causes the VT100 to transmit a code which has a special meaning to your system. Consult your local operating procedures for the meanings of these keys.

Numeric Keypad

The numeric keypad enables numbers to be entered in calculator fashion. Each key in the numeric keypad generates the same character as the corresponding numeric key on the main keyboard. The **ENTER** key corresponds to the **RETURN** key. These keys may also be interpreted by the host computer as special function keys. Consult your local operating procedures for the meanings of these keys.

DELETE

DELETE

This key causes the VT100 to transmit a delete character code to the host system. The deleted character may or may not be erased from the screen.

RETURN

RETURN

This key transmits either a carriage return (CR) code or a carriage return (CR) and linefeed (LF) code. This is a SET-UP selectable feature.

LINEFEED

LINEFEED

This key transmits a linefeed code.

SHIFT

SHIFT

When pressed, this key enables the uppercase function of all keys. If a key does not have an uppercase function the **SHIFT** key will be disregarded.

RESET

RESET

When the terminal is in SET-UP mode, this key starts the reset sequence. This has the same result as turning the terminal power off and then on.

80/132 COLUMNS

80/132 COLUMNS

When the terminal is in SET-UP A mode, this key switches the display line size from 80 to 132 characters per line or from 132 to 80 characters per line.

RECEIVE SPEED

RECEIVE SPEED

When the terminal is in SET-UP B mode, this key steps the terminal through the receive baud rate settings in ascending order.

TRANSMIT SPEED

TRANSMIT SPEED

When the terminal is in SET-UP B mode, this key steps the terminal through the transmit baud rate settings in ascending order.

TOGGLE 1/0

TOGGLE 1/0

When the terminal is in SET-UP B mode, this key turns the selected operational feature on or off.

6 OPERATOR INFORMATION



Figure 1-2 VT100 Keyboard
(cont)

BELL G

When pressed in combination with the **CTRL** key, this key causes a bell code to be sent to the host.

% 5

SET-UP A/B

When the terminal is in SET-UP mode, this key switches the terminal from SET-UP A to SET-UP B or from SET-UP B to SET-UP A.

\$ 4

LINE/LOCAL

In SET-UP mode, this key alternately places the VT100 ON LINE or LOCAL to your system. When it is ON LINE, the VT100 communicates with your system. When it is in LOCAL the VT100 is electrically disconnected from your system.

3

CLEAR ALL TABS

In SET-UP A, this key clears all horizontal tabs set in the VT100.

@ 2

SET/CLEAR TAB

In SET-UP A, this key sets or clears individual horizontal tabs.

CAPS LOCK

This key enables the transmission of uppercase alphabetic characters only. All numeric and special symbol keys remain in lowercase.

NO SCROLL

When first pressed, this key stops the transmission of data from the computer to the VT100. When pressed a second time, transmission resumes from where it was stopped. Check your local operating procedures to ensure that your system recognizes this key.

CTRL

When pressed in combination with another key, the **CTRL** key causes the VT100 to transmit a code which has a special meaning to your system.

TAB

This key transmits a tab code.

ESC

This key transmits a code which normally has a special meaning to your system. In many applications, it tells your system to treat the next keys pressed as a command.

MONITOR CONTROLS

The VT100 monitor contains only two controls: the power switch and the power selector switch, which is used to adapt the terminal to the available ac input voltage range (see specifications).

Audible Indicators (Tones)

There are three audible alarms associated with the VT100: a short tone (click), a long tone (bell), and a series of long tones.

Short Tone (Click) – The short tone is sounded by the terminal whenever a key is pressed, with the following exceptions:

- **SHIFT** or **CTRL** keys do not generate any keyclick because these keys do not transmit any codes but only modify the codes transmitted by other keys.
- KBD LOCKED indicator is turned on; in which case, the characters typed are lost.
- The keyclick feature has been turned off in SET-UP mode.

Long Tone (Bell) – The long tone is sounded by the terminal to indicate one of the following conditions:

- A bell code was received from the computer.
- The cursor is eight characters away from the right margin and the margin bell feature is enabled.

Series of Long Tones – The terminal will sound the long tone several times in rapid succession to indicate that the nonvolatile memory (NVR) had difficulty in reading or writing the SET-UP features. (When this occurs, check the SET-UP features and then perform the Recall or Save operation again.)

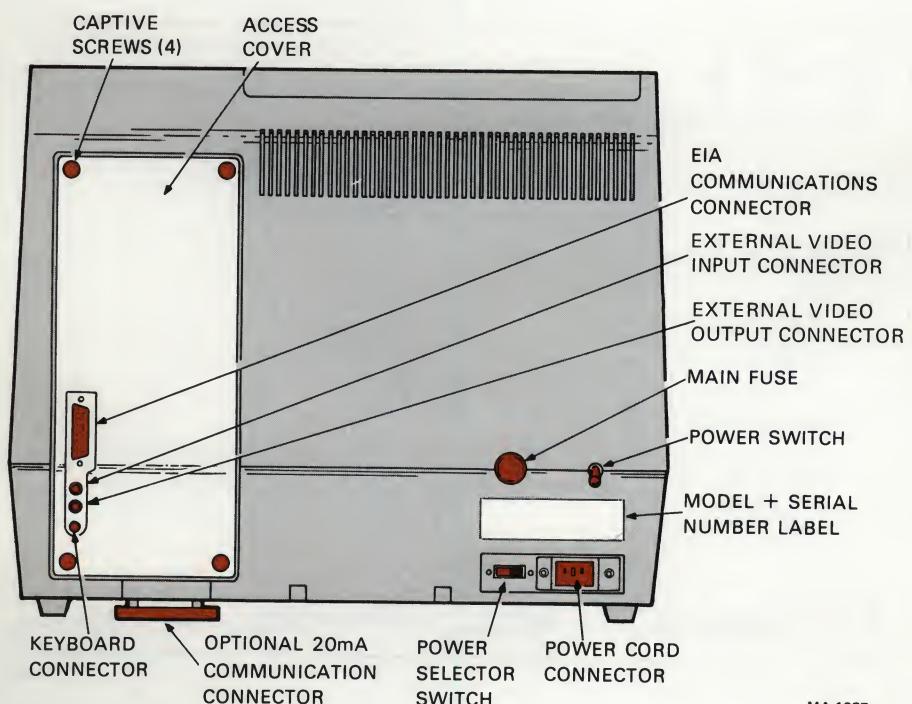


Figure 1-3
VT100 Terminal
(Rear View)

PART 2
SET-UP MODE

Unlike most terminals, the VT100 does not use switches or jumpers to individually turn the built-in terminal features on or off. Instead, the VT100 uses a nonvolatile memory (NVR) which always remembers what features have been selected, as if a switch had been set.

The selection and storage of built-in terminal features is performed in a special mode of operation called SET-UP mode. When you enter SET-UP mode, the status of the features stored in the temporary memory is shown on the screen. You can then change the features and store any new feature selections either temporarily, by leaving SET-UP mode; or on a fixed basis, by performing a Save operation. In either case, the terminal operation will reflect the new feature selection. If a recall operation is performed, or the terminal is reset, or the terminal power is turned OFF, all temporary feature settings are replaced by the features that have been stored on a fixed basis.

SET-UP Features at a Glance

When entered, SET-UP mode provides two brief summaries of the current feature status. The first presentation – SET-UP A – displays the location of the tab stops set in the terminal and a visual ruler which numbers each character position on the line. The second presentation – SET-UP B – summarizes the status of the other terminal features.

SET-UP A – To enter SET-UP A, press the **SET-UP** key. The display will now have a presentation similar to Figure 1-4. The bottom line of the display consists of a "ruler" which numbers each character position available on a line. The location of each tab stop is shown by a "T" placed above the ruler. If the tab stop(s) set are those desired, you may exit SET-UP mode by pressing the **SET-UP** key again or you may now change the tabs to meet your requirements.

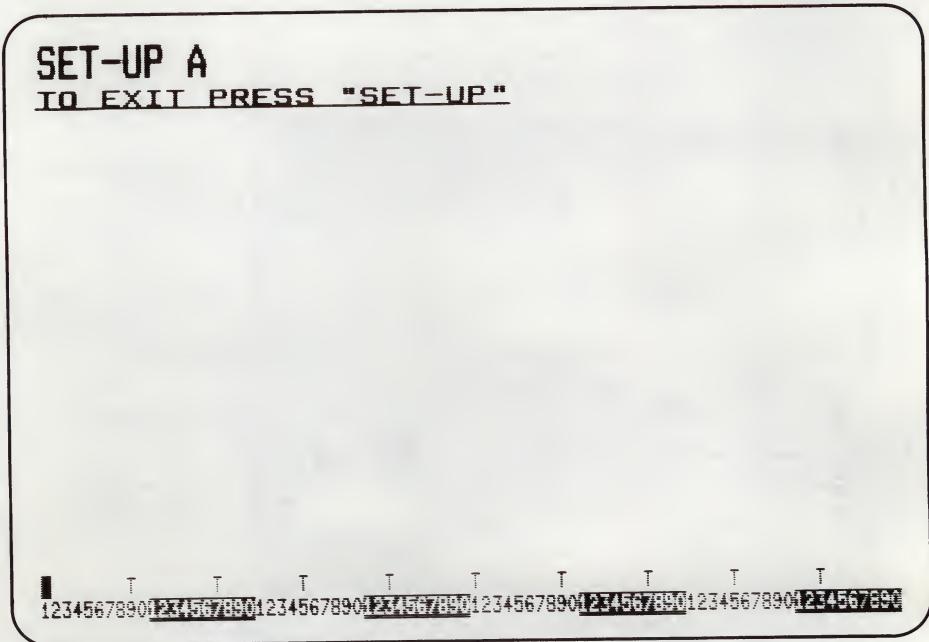


Figure 1-4
SET-UP A Mode Presentation

SET-UP B – SET-UP B mode may only be entered from SET-UP A mode. To enter SET-UP B from SET-UP A, press the **5 key on the main keyboard. The display will then look like Figure 1-5.**

Figure 1-6 summarizes the SET-UP B presentation. This summary allows you to quickly determine what features are enabled. For additional information on a feature refer to the Definition of Each Feature section.

To exit SET-UP B press the **SET-UP** key.

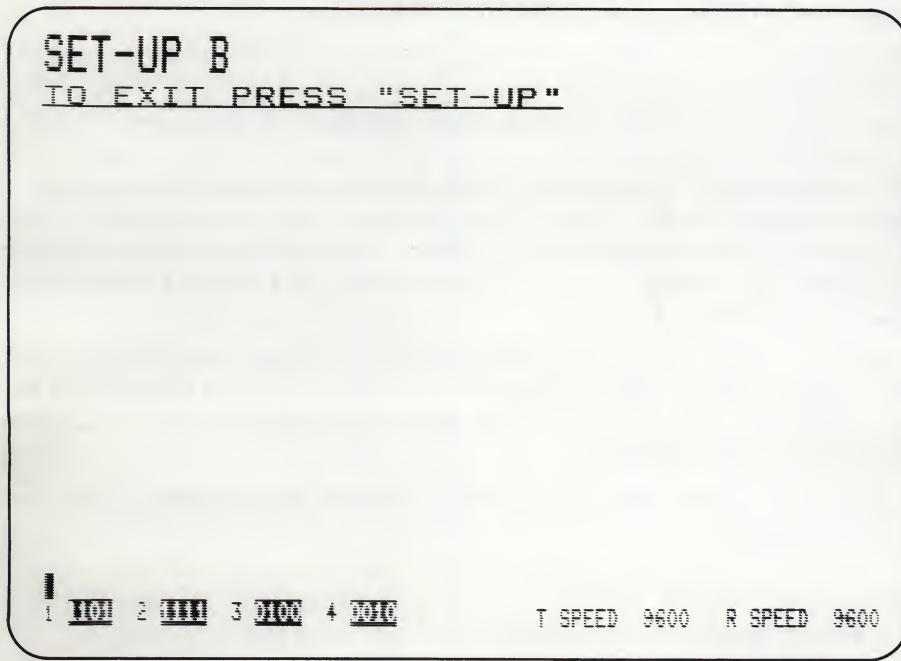


Figure 1-5
SET-UP B Mode Presentation

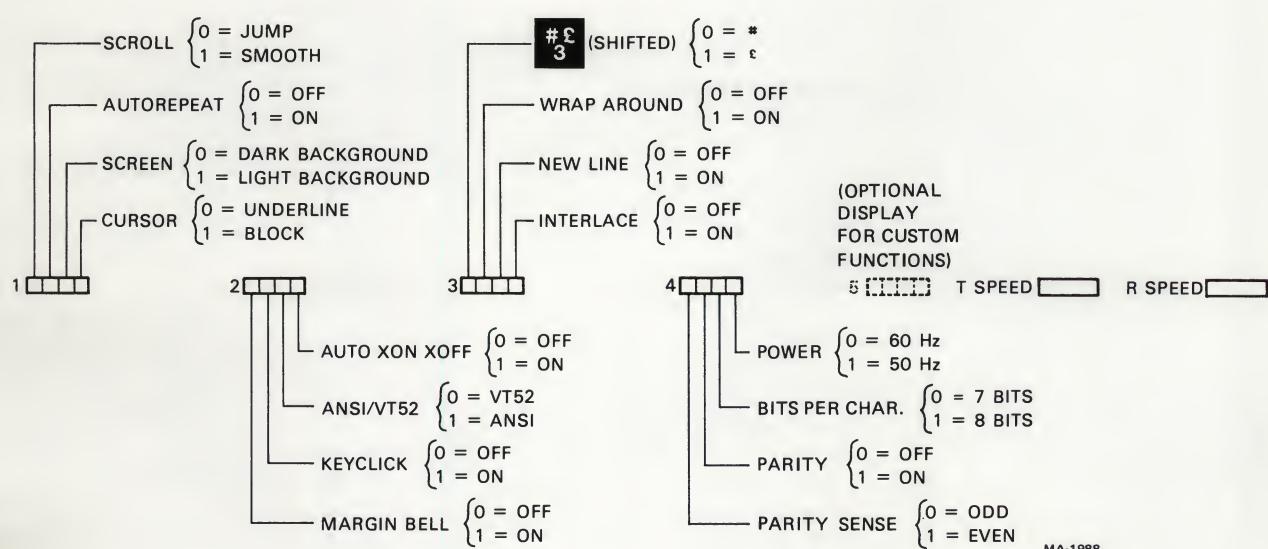


Figure 1-6
SET-UP B Mode Summary

Determining What a SET-UP Feature Does

The SET-UP features are basically a series of options in the VT100 that allow the terminal to be tailored to its operating environment. Table 1-1 lists each feature and places it in one or more of the following general categories:

- Installation
- Computer compatibility
- Operator comfort

The installation category concerns itself with the initial installation of the terminal and any special options that may be attached to the terminal. If any terminal options are added or removed, or the physical location of the installation is changed, verify the settings of these SET-UP features.

Computer compatibility contains the features which must be set correctly so that the VT100 can communicate with the host computer. An error in these settings may cause incorrect data to be sent to or received from the computer; or an error may prevent the VT100 from communicating with the computer. The settings for these features must be obtained from the host computer programmer, operator, or system manager since there are many combinations of settings designed to work with particular computers and special software. These feature settings would normally change only when you need to communicate with a different computer or a unique software package.

The operator comfort category contains the SET-UP features designed exclusively for the operator. These features allow the operator to tailor the VT100 to fit individual preference. These features do not affect any operations that occur between the terminal and the computer.

The next section, Definition of Each SET-UP Feature, describes the specific function of each feature.

Table 1-1
Categories of SET-UP Features

SET-UP Feature	Installation	Computer Compatibility	Operator Comfort
ANSI/VT52 Mode		X	
ANSWERBACK Message		X	
AUTO REPEAT			X
AUTO XON XOFF		X	
BITS PER CHARACTER		X	
CHARACTERS PER LINE		X	
CURSOR			X
INTERLACE	X		
KEYCLICK			X
LINE/LOCAL		X	
MARGIN BELL			X
NEW LINE		X	
PARITY		X	
PARITY SENSE		X	
POWER	X		
RECEIVE SPEED		X	
SCREEN BACKGROUND			X
SCREEN BRIGHTNESS			X
SCROLL		X	
TABS		X	
TRANSMIT SPEED		X	
WRAPAROUND		X	
# £ 3 (shifted)			X

How to Change a SET-UP Feature

Changing any or all of the SET-UP features is a simple operation and is generally performed by following the same basic steps.

1. Enter SET-UP mode by pressing the **SET-UP** key
2. Select the appropriate SET-UP mode by pressing the **5** key on the main keyboard each time you want to switch from SET-UP A to SET-UP B or from SET-UP B to SET-UP A.
3. Position the cursor above the feature switch or tab stop to be changed. To position the cursor, the **SPACEBAR**, **←**, **→**, **TAB** and **RETURN** keys may be used. Some features do not use this step since a specific key is dedicated to changing the feature.
4. Change the feature setting by pressing either the **6** key on the main keyboard or the appropriate dedicated key. Each time the key is pressed the feature will change, generally to the opposite state.

Table 1-2 briefly summarizes the SET-UP features, the SET-UP mode you must be in to change a given feature, and the key used to change the feature setting.

Table 1-2
SET-UP Feature
Change Summary

SET-UP Feature	Changed In			SET-UP Feature	Changed In		
	SET-UP A Mode	SET-UP B Mode	Key Used to Change Feature		SET-UP A Mode	SET-UP B Mode	Key Used to Change Feature
ANSI/VT52 mode	X		^ 6	PARITY		X	^ 6
ANSWERBACK message	X		†	PARITY SENSE		X	^ 6
AUTO REPEAT	X		^ 6	POWER		X	^ 6
AUTO XON/XOFF	X		^ 6	RECEIVE SPEED		X	* 8
BITS PER CHARACTER	X		^ 6	SCREEN BACKGROUND		X	^ 6
CHARACTERS PER LINE	X		(9	SCREEN BRIGHTNESS	X	X	↑ or ↓
CURSOR	X		^ 6	SCROLL		X	^ 6
INTERLACE	X		^ 6	TABS	X		@ 2 and # 3
KEYCLICK	X		^ 6	TRANSMIT SPEED		X	& 7
LINE/LOCAL	X	X	\$ 4	WRAPAROUND		X	^ 6
MARGIN BELL	X		^ 6	# £ 3 (shifted)		X	^ 6
NEW LINE	X		^ 6				

†A special sequence is required for this feature.

Setting the Answerback Message

Setting the answerback message is different from setting any of the other terminal features. An answerback message can be typed into the VT100, using the following steps:

1. Place the terminal in SET-UP B mode.
2. Press the **SHIFT** and **A** key simultaneously. The terminal will respond by placing **A =** on the screen. (The **SHIFT** key is required. The **CAPS LOCK** key will not work here.)
3. Type the message delimiter character which may be any character not used in the actual answerback message. The message delimiter character is not a part of the answerback message. If a mistake is made when typing the answerback message, type the message delimiter character again and go back to step 2. This is the *only* way to correct errors in the answerback message.
4. Type the answerback message. The message may be up to 20 characters, including space and control characters. Control characters will be displayed as a ♦ character to indicate their presence in the message.
5. Type the message delimiter character. Once the message delimiter character is typed the answerback message will disappear from the screen.

Once the above steps have been completed the answerback message will be temporarily stored in the VT100 and can be saved with the Save operation.

Saving the SET-UP Features

SET-UP features may be changed and stored on either a temporary or a fixed basis. To temporarily store a feature, exit SET-UP mode after changing the feature; the terminal now reacts according to the new setting. If a recall operation is performed, or the terminal is reset, or the terminal power is turned off, all temporary feature settings are replaced by the features that have been stored on a fixed basis.

To store SET-UP feature settings on a fixed basis, perform a save operation. This is a simple operation that is accomplished by performing the following steps:

NOTE

The save operation must be performed at the terminal keyboard. The computer cannot perform this operation, although it can temporarily modify the settings of some VT100 features.

1. Place the terminal in SET-UP mode.

2. Press the **SHIFT** and **S** keys simultaneously. The screen will clear and the message "wait" will be displayed in the upper-left corner. After a brief wait, the terminal will return to SET-UP A mode.

Once these steps have been performed, SET-UP features which had been temporarily stored will now be stored on a fixed basis.

Recalling SET-UP Features

The temporarily stored SET-UP feature settings may differ from the settings which have been stored on a fixed basis. If you wish to return to the fixed settings, perform the recall operation as follows:

NOTE

When a recall operation is performed the contents of the screen are destroyed.

1. Place the terminal in SET-UP mode.

2. Press the **SHIFT** and **R** keys simultaneously. The screen will clear and the message "wait" will appear in the upper-left corner of the screen. After a brief wait the terminal will return to SET-UP A mode.

Resetting the Terminal

The VT100 may be reset from the keyboard. When the terminal is reset, the terminal memory is cleared and the self-test program is run as if the terminal power switch had been turned OFF and then back ON. To reset the terminal:

1. Place the terminal in SET-UP mode.
2. Press the **0** key on the main keyboard. The VT100 will be reset, the power on self-test will be run, and the terminal will set according to the fixed SET-UP features.

NOTE

When a reset operation is performed the contents of the screen are destroyed and any options present may be affected.

PART 3 DEFINITION OF EACH SET-UP FEATURE

This section describes each SET-UP feature in detail (in alphabetical order) and states how each feature affects the terminal.

ANSI/VT52 Mode

The VT100 terminal follows two different programming standards – American National Standards Institute (ANSI) and VT52. In ANSI mode, the VT100 will generate and respond to coded sequences per ANSI standards X3.41-1974 and X3.64-1977. In VT52 mode, the VT100 terminal is compatible with previous DIGITAL software using the VT52 video terminal. Both ANSI and VT52 modes are outlined in the programmer's section of this manual.

ANSWERBACK Message

Answerback is a question and answer sequence where the host computer asks the terminal to identify itself. The VT100 answerback feature provides the terminal with the capability to identify itself by sending a message to the host. The entire answerback sequence takes place automatically without affecting the screen or requiring operator action. The answerback message may also be transmitted by typing **CTRL - BREAK**

AUTO REPEAT

The auto repeat feature allows a key to be automatically repeated at the rate of about 30 characters per second when the key is held down for more than one-half second. The auto repeat feature affects all keyboard keys except the following:

SET-UP	TAB
ESC	RETURN
NO SCROLL	CTRL and any key

AUTO XON/XOFF

The VT100 is capable of automatically generating synchronizing codes XON (DC1) and XOFF (DC3). The XOFF code is used to stop the transmission of data from the computer to the terminal; the XON code is used to resume transmission. With the feature enabled, the VT100 will generate the XOFF code when one of the following events occur:

1. The internal buffer is nearly full
2. The **NO SCROLL** key is pressed
3. The terminal is placed in SET-UP mode
4. **CTRL - S** is pressed.

NOTE

Unless otherwise stated, entering SET-UP mode and changing features does not result in the loss of data displayed on the screen.

NOTE

The VT100 will always stop transmission when an XOFF (DC3) code is received and will resume transmission when an XON (DC1) code is received regardless of the AUTO XON/XOFF feature setting.

When either the buffer empties, the **NO SCROLL** key is pressed again, the terminal is taken out of SET-UP mode, or **CTRL - Q** is pressed, the VT100 will transmit the XON code to resume transmission from the computer to the terminal.

If the host computer software does not support the XON/XOFF codes, data sent during buffer full conditions, or when the terminal is in SET-UP mode, may be lost.

BITS PER CHARACTER

This feature allows the terminal to transmit and receive either 7- or 8-bit characters. When set for 8-bit operation, bit 8 is set to a space (or 0) for characters transmitted and is ignored for all characters received.

NOTE

When changing from 80 to 132 character per line mode or vice-versa, the current contents of the screen are lost.

The use of double-width characters reduces the number of characters per line by half.

CHARACTERS PER LINE

The VT100 is capable of displaying either 80 or 132 characters per line. In the 80 character per line mode, the screen is 80 characters wide by 24 lines high. In the 132 character per line mode, the screen is 132 characters wide by 14 lines high (24 lines if the VT100 is equipped with the Advanced Video Option). In the 132 character per line mode, the displayed lines are physically the same width as in the 80 character per line mode but the characters are more compact.

CURSOR

The VT100 offers a choice of two cursor representations to indicate the "active position", or where the next character will be placed on the screen. The cursor may be displayed as either a blinking underline (—) or a blinking block (■). The cursor selection may perform an additional function; see the SGR escape sequence definition in Chapter 3.

INTERLACE

This feature is used for high resolution options. To reduce screen flicker the interlace feature should be turned off if such an option is not installed.

KEYCLICK TONE

The keyclick is a tone which is generated every time a code transmitting key is pressed. The keyclick may be turned on or off to suit the operator's needs. However, research and experience has shown that an operator is more accurate when there is an audible feedback from the keyboard.

Like the bell tone, the keyclick volume is *not adjustable*.

LINE/LOCAL

The LINE/LOCAL feature allows the operator to easily place the terminal in either an ON-LINE or a LOCAL (off-line) condition. When the terminal is on-line (the keyboard ON-LINE indicator is ON) all characters typed on the keyboard are sent directly to the computer and messages from the computer are displayed on the screen. In the LOCAL condition (the keyboard LOCAL indicator is ON), the terminal is electrically disconnected from the computer; messages are not sent to or received from the computer; and characters typed on the keyboard are echoed on the screen directly.

MARGIN BELL

The margin bell feature is much the same as the bell in a typewriter. If the cursor is eight characters from the end of the current line while typing, the VT100 sounds a tone to alert the operator.

NEW LINE

The new line feature enables the **RETURN** key on the terminal to function like the **RETURN** key on an electric typewriter. When the new line feature is enabled, pressing the **RETURN** key generates the carriage return (CR) and line feed (LF) codes. When a line feed code is received, the code is interpreted as a carriage return and line feed.

When the new line feature is disabled, the **RETURN** key generates only the CR code; an LF code causes the terminal to perform a line feed only.

NOTE

If double line feeds occur consistently, turn this feature off since the computer is already performing this function automatically.

PARITY

Parity, when enabled, checks for correct data transmission. If a transmission error occurs, the VT100 can detect it and indicate its presence by placing a checkerboard character () on the screen in place of the character with the error. The parity sense feature determines if the parity is even or odd. When parity is disabled, no parity bit is transmitted or received.

NOTE

If the parity feature is turned off, the parity sense selection will be disregarded.

PARITY SENSE

The parity sense feature defines which of the two methods of parity checking, odd or even, is being used by the VT100. If the parity feature is on, the terminal's parity sense must be matched to the parity the computer is sending. If the parity sense features do not match, most characters sent to the computer will be rejected even though the character was received correctly by the VT100. If a parity incompatibility occurs, the checkerboard character () will be shown on the screen in place of the received character.

POWER

During the initial installation, the terminal display must be set to the power line frequency. In the U.S. this is set to 60 hertz.

RECEIVE SPEED

The receive speed must be set to match the computer transmit speed. The VT100 is capable of receiving at any one of the following preselected speeds: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 9600, 19,200 baud.

The receive speed is independent of the transmit speed; the terminal may receive data at one speed and transmit data at a different speed.

SCREEN BACKGROUND

The screen background feature of the VT100 allows the operator to determine the background of the screen. In the normal screen mode, the display contains light characters on a dark background; in the reverse screen mode, the display contains dark characters on a light background.

SCREEN BRIGHTNESS

Unlike most video terminals, the VT100 does not contain switches or knobs to adjust screen brightness. Instead, the VT100 electronically controls the screen brightness. This feature eliminates the high failure rate of mechanical controls and still allows the operator to select the desired level of brightness for maximum comfort under varied lighting conditions. This setting may be saved like any other feature in the terminal.

NOTE

Smooth scroll mode allows a maximum of six lines of data per second to be added to the screen. The Auto XON/XOFF feature must be enabled and supported by the host computer to ensure that data is not lost when smooth scroll mode is enabled.

SCROLL

Scrolling is the upward or downward movement of existing lines on the screen to make room for new lines at the bottom or top of the screen. It can be performed in two ways: jump scroll or smooth scroll. In jump scroll mode, new lines appear on the screen as fast as the computer sends them to the terminal. At the higher baud rates, the data is very difficult to read due to the rapid movement of the lines. In smooth scroll mode, a limit is placed on the speed at which new lines of data may be sent to the terminal. The movement of lines occurs at a smooth steady rate allowing the data to be read as it appears on the screen.

TABS

Just like a typewriter, the VT100 can jump or tab to preselected points on a line. These tab stops may be individually changed, or totally cleared and then set.

TRANSMIT SPEED

Transmit speed must be set to match the computer receive speed. The VT100 is capable of transmitting at any one of the following preselected transmit speeds: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 9600, and 19,200 baud.

Transmit speed is independent of receive speed; the terminal may transmit data at one speed and receive data at a different speed.

WRAPAROUND

When this feature is enabled, the 81st or 133rd character (depending upon the line size selected) inserted on a line is automatically placed in the first character position of the next line. If the wraparound feature was not enabled, the 81st or 133rd character and all following characters would be overwritten into the last character position of the current line.

£ (shifted)

The VT100 contains character sets for the U.S. and the United Kingdom. The difference between the two character sets is one character, the # or £ symbol. When the standard U.S. character set is selected, the uppercase 3 key on the main keyboard displays the # character. The £ character is displayed when the U.K. character set is selected.

PART 4
SELF-TESTING
THE VT100

A self-test mode is built into the VT100 that automatically, or on command, tests the condition of the terminal should a fault be suspected. The self-test program checks the following items:

- Advanced Video Memory (if option is installed)
- Nonvolatile Memory (NVR)
- Internal Memory
- Keyboard

This test is performed automatically whenever the terminal is turned on.

Self-Test Error Codes

There are two broad categories of errors: fatal and nonfatal.

Fatal errors cause the terminal to immediately stop all operations. No intelligible information is displayed on the screen; however, the screen most likely contains a random pattern of characters. The only error indication (in addition to the random characters) is a possible error code displayed on the programmable keyboard LEDs, L1—L4; however, no terminal function, including the lighting of LEDs, is guaranteed if a fatal error is found.

Nonfatal errors do not halt the terminal processor. Instead, the terminal is forced to LOCAL mode and an error code character is displayed in the upper-left corner of the screen.

There are five types of nonfatal errors:

1. (AVO) Advanced Video Option data RAM
2. (NVR) Nonvolatile data RAM checksum error
3. (KBD) Keyboard missing or malfunction
4. (Data) Data loopback error
5. (EIA) EIA modem control error

Table 1-3 shows the possible nonfatal error characters that may appear on the screen and the failure represented by each character.

NOTE

The loopback and EIA modem control tests are not performed on power-up; they must be invoked separately with the proper escape sequence. See the programmer's section for further information on these tests.

Character Displayed	Fault Detected				
	AVO	NVR	KBD	Data	EIA
1	X				
2		X			
3	X	X			
4			X		
5	X	X			
6		X	X		
7	X	X	X		
8				X	
9	X		X		
:		X	X		
:	X	X	X		
<		X	X		
=	X	X	X		
>		X	X	X	
?	X	X	X	X	

Character Displayed	Fault Detected				
	AVO	NVR	KBD	Data	EIA
@					X
A		X			X
B			X		X
C		X	X		X
D				X	X
E		X		X	X
F			X	X	X
G		X	X	X	X
H					X
I		X			X
J			X		X
K		X	X		X
L				X	X
M		X		X	X
N			X	X	X
O	X	X	X	X	X

Table 1-3
Nonfatal Displayed
Error Codes

PART 5
WHAT TO DO
IN THE EVENT
OF A PROBLEM

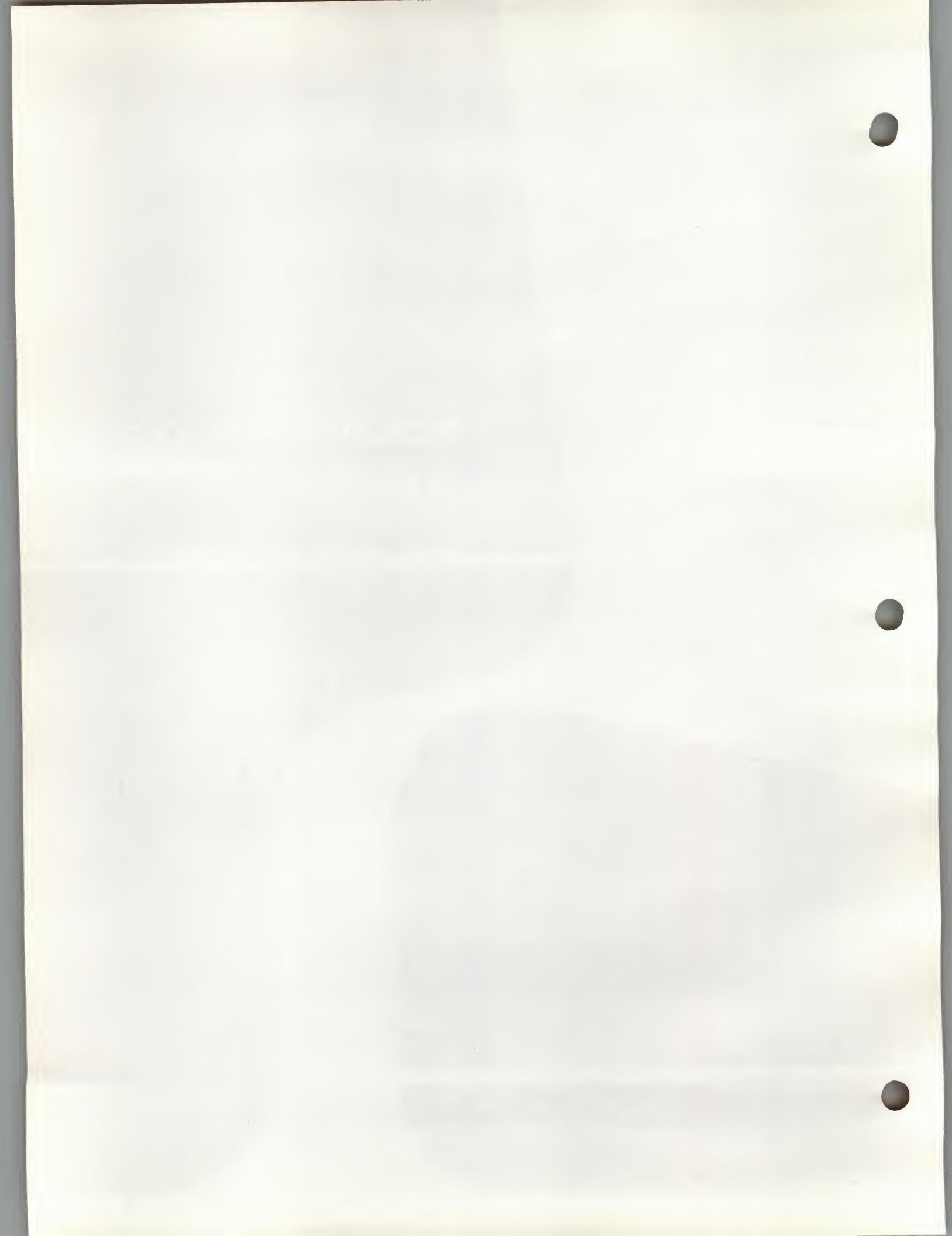
If it appears that there is a problem in the terminal, you should initiate the power-up self-test program. This test will help to determine if the problem lies in your terminal or in some other part of the computer system. Table 1-4 describes the items an operator can check prior to making a service call.

Table 1-4
Problem Checklist

Symptom	Possible Cause and Corrective Action
VT100 will not turn ON when the power switch is set to ON.	AC power cord is not plugged into wall outlet; plug in cord. AC power cord is not plugged into the terminal; plug in cord.
	Power is not coming from the wall outlet; check outlet with a known working electrical device (such as a lamp). If no power, call your electrician.
	AC line fuse blown; turn terminal OFF and have the fuse replaced. (See Figure 1-2 for location.)
No keyboard response	Keyboard cable not plugged into monitor; plug in keyboard cable.
	KBD LOCKED indicator on; computer has turned the keyboard off. The KBD LOCKED conditions may be cleared by entering and exiting the SET-UP mode. If this condition persists, check with the host computer software people for a possible operating error.
	Perform the self-test operation.
Garbled or Error (???) Characters	Incorrect SET-UP feature selection; correct the SET-UP features. Suggested SET-UP features which may be in error:
	ANSI/VT52 mode Auto XON/XOFF Bits per character Parity Parity sense Receiver speed Transmit speed
	Perform the self-test operation.
Several successive long tones	The terminal has had difficulty in reading or writing the SET-UP features stored in non-volatile memory. Check the feature settings and perform the save operation.
	Perform the self-test operation.



Installation, Interfacing and Specifications



CHAPTER 2

INSTALLATION, INTERFACE INFORMATION, AND SPECIFICATIONS

SITE CONSIDERATIONS

The design of the VT100 terminal (Figure 2-1) will normally pose few constraints on selecting a place in which to install the terminal. In most cases, any environment suitable to the terminal operator will be a satisfactory environment in which to operate the terminal. Extremes of temperature and humidity should be avoided. A summary of VT100 guaranteed operating conditions is found at the end of this section.

INSTALLATION

UNPACKING AND INSTALLATION

The VT100 shipping carton contains the following items:

- VT100 monitor
- VT100 detached keyboard
- VT100 power cord
- VT100 SET-UP label
- VT100 User's Guide

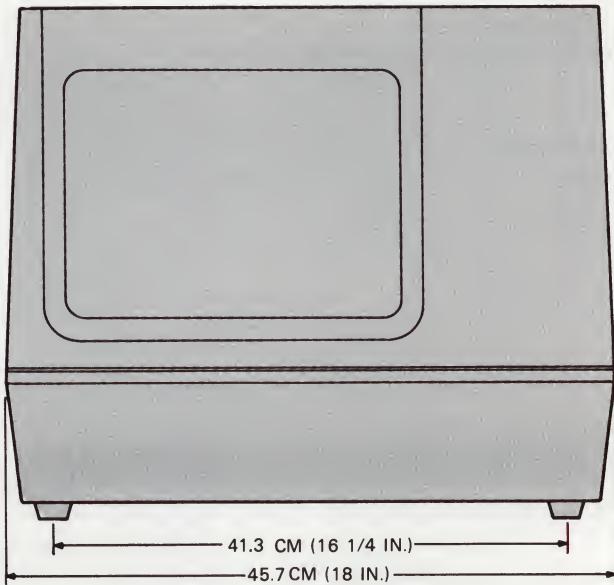
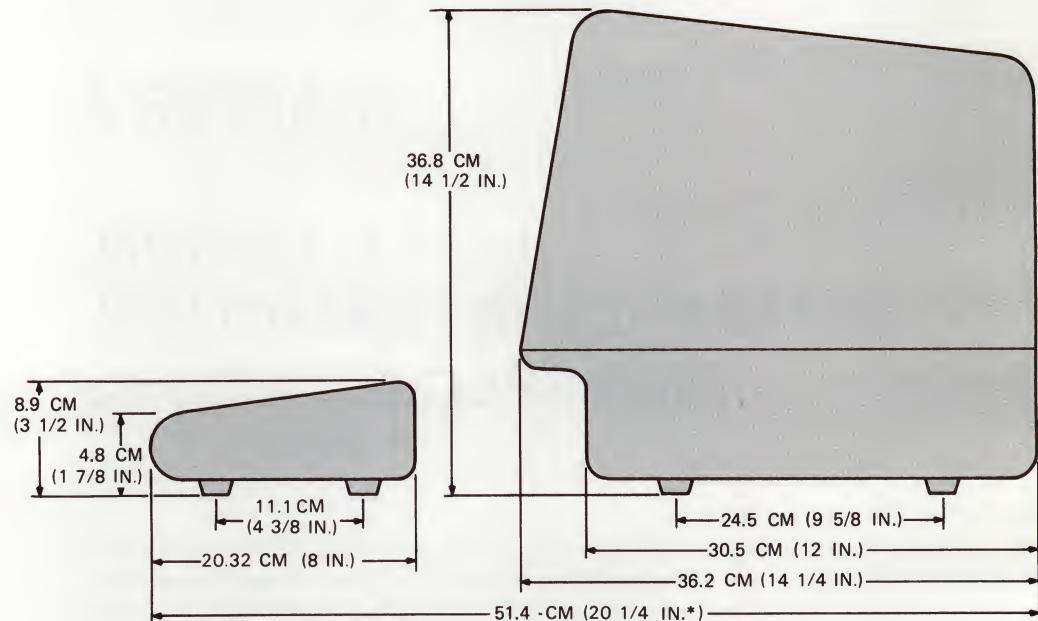


Figure 2-1

VT100 Terminal Dimensions

* MEASUREMENT TAKEN WITH THE KEYBOARD PLACED FLUSH TO FRONT OF TERMINAL UNDER UNDERCUT.

MA-1991

To install the VT100 perform the following steps:

1. Remove the VT100 from the shipping carton and place it in the desired work area.
2. Place the keyboard in front of the terminal and plug the keyboard coiled cord into the keyboard receptacle located on the rear of the terminal (Figure 2-2).
3. Verify that the power selector switch shows the correct wall outlet voltage (115 V is standard in the U.S.) and the power switch is off.
4. Connect the power cord to the power cord receptacle on the rear of the terminal and plug the other end of the power cord into a nearby wall outlet.
5. Connect the communications cable to the appropriate communications receptacle.
6. Turn the power switch on. The terminal will now automatically perform the power-up self test and either the ON LINE or LOCAL light located on the keyboard will be turned on. After approximately one minute the cursor will be visible in the upper-left corner of the screen. If any other indication is shown, refer to Part 5 of the operator information chapter.
7. Set the desired SET-UP features as outlined in the operator's section of this manual.
8. Once the installation setup procedure is complete, record the SET-UP features selected on the VT100 SET-UP label and attach the label to the underside of the keyboard.

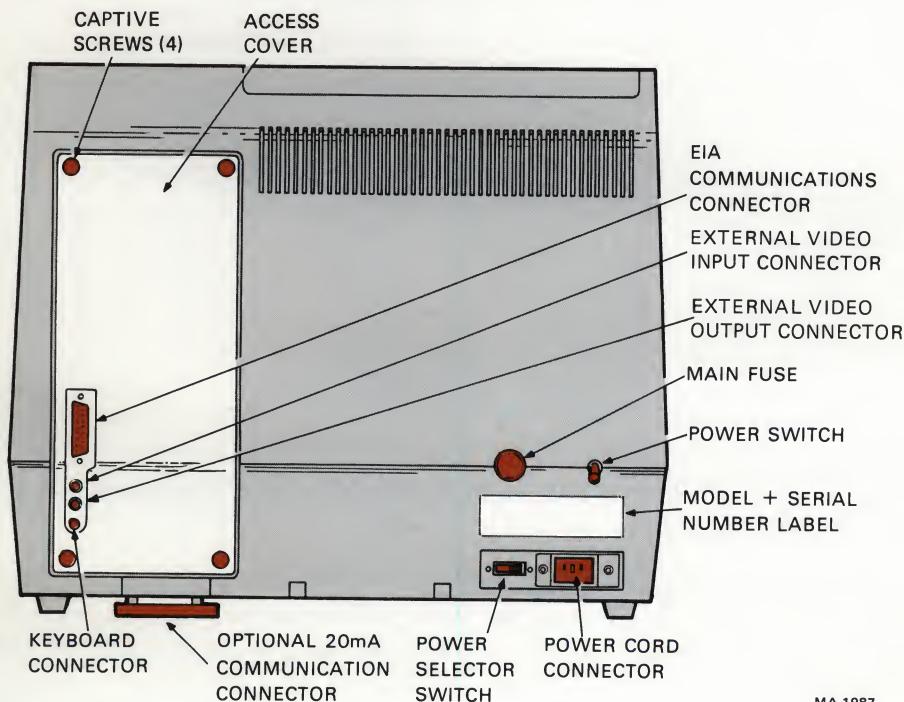


Figure 2-2
VT100 Rear View

USER MAINTENANCE

The keyboard keys are the only moving parts of the terminal and require no preventive maintenance by the owner. The VT100 surfaces may be cleaned with soap and water or any mild detergent. Cleaners with solvents should not be used.

The VT100 packaging is not meant to be weatherproof; there are several openings in the case through which liquids, coins, paper clips, and other objects can fall. Such objects would disturb the electronic operation of the terminal if they came into contact with the circuitry. For this reason, avoid putting drinks and metal objects on the top of the terminal, or using excessive water to clean the terminal. Rubbing the keys with a dry or barely moist cloth should suffice to clean them. Do not remove the keycaps to clean them more thoroughly; damage may result to the switch contacts if they are replaced incorrectly.

Keep the ventilation slots clear. Blocking these slots by placing objects on top of or under the VT100 may cause the terminal to overheat.

INTERFACE INFORMATION

EIA Interface The basic VT100 operates on full duplex, asynchronous communication lines. The terminal interfaces to the line with a 25-pin connector mounted on the back of the terminal which meets the requirements of EIA specification RS-232-C. Table 2-1 summarizes the EIA connector signals; the following paragraphs explain each signal as used in the basic VT100.

Table 2-1
EIA RS-232-C
Connector Signals

Pin Number	Description	Pin Number	Description
1	Protective ground	14	(not used)
2	Transmitted data	15	Transmit clock
3	Received data	16	(not used)
4	Request to send	17	Receive clock
5	Clear to send	18	(not used)
6	Data set ready	19	Speed select
7	Signal ground (common return)		(secondary request to send)
8	Carrier detect	20	Data terminal ready
9	(not used)	21	(not used)
10	(not used)	22	Ring indicator
11	Same as pin 19	23	Same as pin 19
12	Speed indicator (secondary carrier detect)	24	(not used)
13	(not used)	25	(not used)

Protective Ground – Pin 1

This conductor is electrically bonded to the VT100 chassis. Use of this conductor for reference potential purposes is not allowed.

Transmitted Data (from VT100) – Pin 2

The VT100 transmits serially encoded characters and break signals on this circuit, which is held in the mark state when neither characters nor break signals are being transmitted.

Received Data (to VT100) – Pin 3

The VT100 receives serially encoded characters generated by the user's equipment on this circuit.

Request to Send (from VT100) – Pin 4

Asserted at all times when terminal is powered up.

Clear to Send (to VT100) – Pin 5

Ignored at all times.

Data Set Ready (to VT100) – Pin 6

Ignored at all times.

Signal Ground – Pin 7

This conductor establishes the common ground reference potential for all voltages on the interface. It is permanently connected to the VT100 chassis.

Carrier Detect (to VT100) – Pin 8

Ignored at all times.

Speed Select (from VT100) – Pins 11, 19, and 23

This signal is alternately called Secondary Request to Send. The basic VT100 maintains this line in the asserted state at all times.

Speed Indicator (to VT100) – Pin 12

This signal, alternately called Secondary Carrier Detect, is ignored at all times.

Transmission Clock (to VT100) – Pin 15

Ignored at all times.

Receive Clock (to VT100) – Pin 17

Ignored at all times.

Data Terminal Ready (from VT100) – Pin 20

Data Terminal Ready is asserted at all times except under the following conditions:

1. Terminal is not powered up
2. Terminal is in LOCAL mode
3. The 3.5 second interval following the pressing of **SHIFT-BREAK**.

Ring Indicator (to VT100) – Pin 22

Ignored at all times.

Electrical Characteristics

VT100 Output Voltages – On signals designated "from VT100," the mark, or unasserted state, is -6.0 V to -12.0 V ; the space, or asserted state, is $+6.0\text{ V}$ to $+12.0\text{ V}$.

VT100 Input Voltages – On signals designated "to VT100," -25.0 V to $+0.75\text{ V}$ or an open circuit is interpreted as a mark or unasserted state, and $+25.0\text{ V}$ to $+2.25\text{ V}$ is interpreted as a space or asserted state. Voltages greater in magnitude than $\pm 25\text{ V}$ are not allowed. These levels are compatible with EIA STD RS-232-C and CCITT Recommendation V.28.

Optional 20 mA Current Loop Interface

In most current loop applications, the VT100 will be connected in a passive configuration — that is, current is supplied to the VT100. In this mode, the transmitter and receiver are both passive, both optically isolated, and the transmitter goes to the mark state when power is turned off.

Conversion from active to passive (or vice versa) requires moving a slide switch.

In active mode either the transmitter or the receiver or both may be connected so that the VT100 sources the 20 mA of current. In active mode isolation is not present and the transmitter will go to the space state when power to the VT100 is turned off.

Figure 2-3 shows the 20 mA current loop interface connector mounted to the access cover and the individual pin assignment.

Electrical Characteristics

The electrical characteristics of the 20 mA current loop interface are shown below:

Transmitter			Receiver		
	Min	Max		Min	Max
Open circuit voltage	5.0 V	50 V	Voltage drop marking	—	2.5 V
Voltage drop marking	—	4.0 V	Spacing current	—	3.0 mA
Spacing current	—	2.0 mA	Marking current	15 mA	50 mA
Marking current	20 mA	50 mA			

In addition to the above specifications for passive operation, active mode will place the transmitter or receiver in series with a source of $17 \text{ V} \pm 5$ percent and 660 ohms.

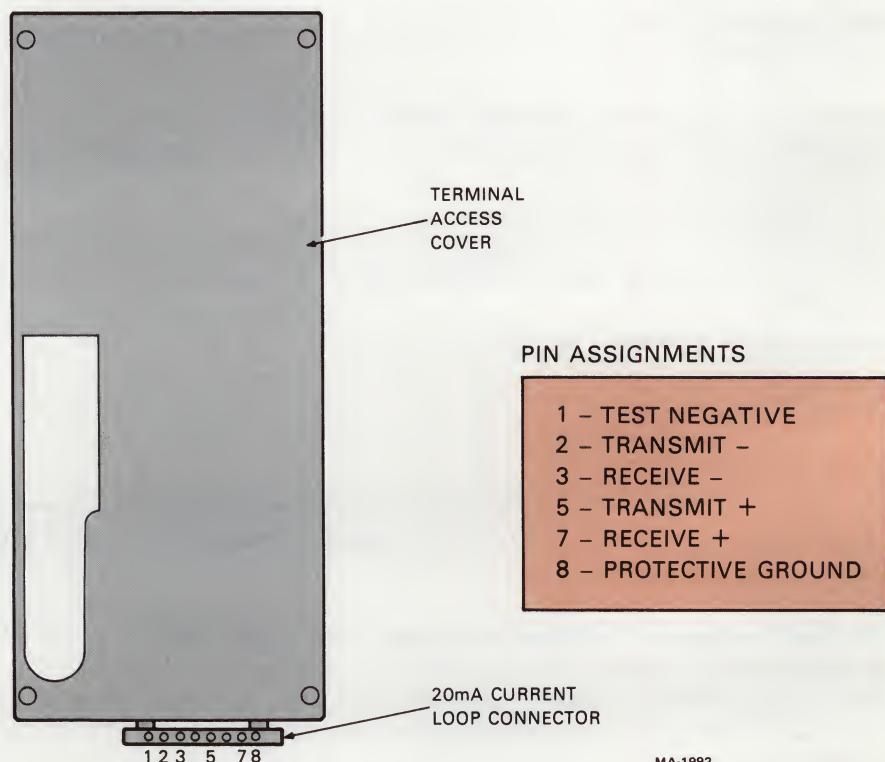


Figure 2-3
20 mA Current Loop Interface

External Video Connections

In addition to the EIA interface, the VT100 is also capable of easily interfacing to external video devices. The video devices may act either as a slave to the VT100 when connected to the composite video output or provide synchronized video to the VT100 video section when connected to the video input. The external video connectors are the two female BNC connectors located on the back of the terminal just below the EIA connector. The upper connector, J8, is the video input while the lower connector, J9, is the video output.

Composite Video Output (J9)

The composite video output provides RS170-like output (see note) generated by combining the video signal with a composite sync signal. This output contains all video data appearing on the VT100 screen except that video which comes from J8. The output has the following nominal characteristics. (Refer to Figure 2-4.)

1. Output impedance = 75 ohms, dc-coupled
2. Sync level = 0 V
3. Black level = approximately 0.3 V when loaded with 75 ohms
4. White level = approximately 1.0 V with a 75 ohm load
5. The composite sync waveform conforms to EIA RS170 standards. The vertical interval is composed of six equalizing pulses, six vertical sync pulses, and six more equalizing pulses. The timing is as follows:

Equalizing pulse width	= 2.33 μ s \pm 50 ns
Vertical pulse width	= 27.28 μ s \pm 200 ns
Horizontal pulse width	= 4.71 μ s \pm 50 ns
Horizontal blank width	{ = 11.84 μ s \pm 50 ns/80 column mode = 12.34 μ s \pm 50 ns/132 column mode
Front Porch	= 1.54 μ s \pm 50 ns

NOTE

The use of dc-coupling is not in strict agreement with RS170. To agree with RS170 the output load requires a 10 μ F capacitor in series with the output. Failing to do so, the 2 mA dc short circuit current requirement is violated. This presents no problem with most monitors which are in fact ac-coupled.

Video Input (J8)

An analog signal applied to the video input will be "ORed" with the internal video signal in such a way that the beam intensity at any point on the screen will correspond to the intensity of that signal which would tend to make the beam brighter at that point. A video signal on this input affects only the internal screen and does not appear on the composite video output. This input has the following nominal characteristics.

1. Input impedance = 75 ohms, dc-coupled
2. Black level = 0 V
3. White level = 1.0 V
4. Maximum continuous input = \pm 2.0 V

The external video source must be synchronized to the VT100; it may do this by referencing the composite sync on the composite video output. This means that the VT100 video input will not synchronize with any composite video source including the composite video output of another VT100.

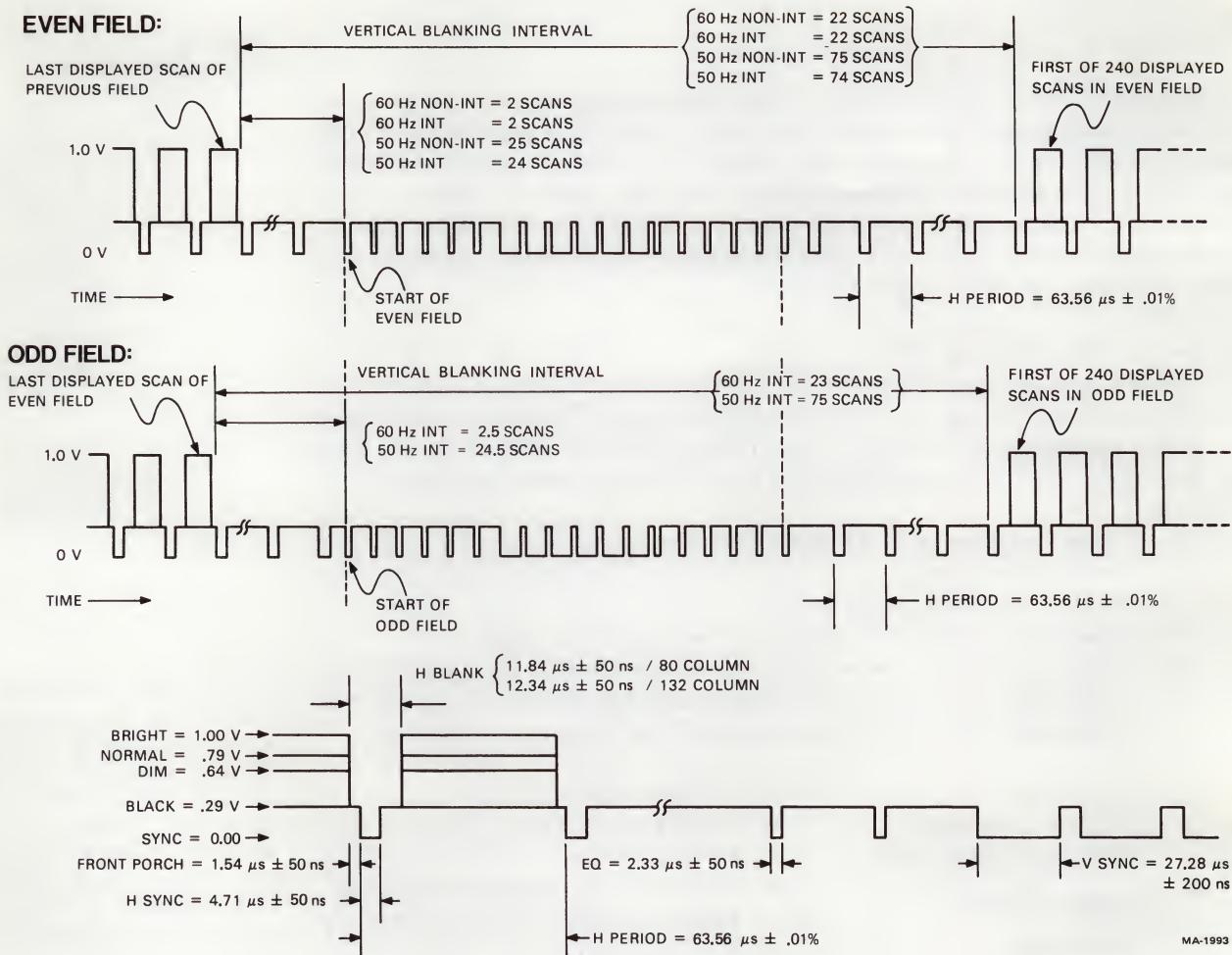


Figure 2-4
Composite Video Output

VT100 SPECIFICATIONS

Dimensions	Monitor	Height: 36.83 cm (14.5 inch) Width: 45.72 cm (18 inch) Depth: 36.20 cm (14.25 inch)
	Keyboard	Height: 8.89 cm (3.5 inch) Width: 45.72 cm (18 inch) Depth: 20.32 cm (8 inch) Minimum table depth: 51.4 cm (20.25 inch)
Weight	Monitor	13.6 kg (30 lbs)
	Keyboard	2.0 kg (4.5 lbs)
	Shipping Weight	18.6 kg (41 lbs)

Operating	Temperature: 10° to 40° C (50° to 104° F) Relative humidity: 10% to 90% Maximum wet bulb: 28° C (82° F) Minimum dew point: 2° C (36° F) Altitude: 2.4 km (8,000 ft)	Environment
Non-Operating	Temperature: -40° to 66° C (-40° to 151° F) Relative humidity: 0 to 95% Altitude: 9.1 km (30,000 ft)	
Line Voltage	90-128 V RMS single phase, 2 wire 180-256 V RMS single phase, 2 wire (switch-selectable)	Power
Line Frequency	47-63 Hz	
Current	2.2 A RMS maximum at 115 V RMS 1.1 A RMS maximum at 230 V RMS	
Input Power	250 VA apparent 150 W maximum	
Current limiting	3 A normal blow fuse	
Power cord	detachable, 3 prong, 1.9 m (6 ft)	
CRT	12 inch diagonal measure, P4 phosphor	Display
Format	24 lines X 80 characters or 14 lines X 132 characters (selectable)	
Character	7 X 9 dot matrix with descenders	
Character size	3.35 mm X 2.0 mm (0.132 inch X 0.078 inch) in 80 column mode 3.35 mm X 1.3 mm (0.132 inch X 0.051 inch) in 132 column mode	
Active Display Size	202 mm X 115 mm (8 inch X 4.5 inch)	
Character Set	96 character displayable ASCII subset (uppercase, lowercase, numeric and punctuation)	
Cursor type	Keyboard-selectable, blinking block character or blinking underline.	
General	83-key detachable unit with a 1.9 m (6 ft) coiled cord attached	Keyboard
Key Layout	65-key arrangement and sculpturing similar to standard typewriter keyboard with an 18-key auxiliary keypad.	
Auxiliary Keyboard	18-key numeric pad with period, comma, minus, enter, and four general-purpose function keys	
Visual Indicators	Seven LEDs; three LEDs dedicated to ON LINE, LOCAL and KBD LOCKED, four LEDs user-programmable.	

Audible Signals	Key-click: sound simulates typewriter. Bell: 1) sounds upon receipt of BEL code; 2) sounds eight characters from right margin (keyboard-selectable). Multiple bell: sounds upon detection of error in SET-UP save or recall operation.
Communication Type	EIA
Speeds	Full duplex: 50, 75, 110 (two stop bits), 134.5, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 9600, 19,200
Code	ASCII
Character Format	Asynchronous
Character Size	7 or 8 bits; keyboard-selectable. (Note: If 8-bit character is selected, eighth bit is always space.)
Parity	Even, odd, or none – keyboard-selectable
Synchronization	Keyboard-selectable via automatic generation of XON and XOFF control codes.

HOW TO ORDER HARDWARE DOCUMENTATION

The following VT100 Video Terminal hardware manuals can be purchased from DIGITAL's Accessory and Supplies Group.

Part No.	Title
EK-VT100-UG	VT100 User Guide
EK-VT100-J1	VT100 Mini Maintenance Manual
EK-VT100-TM	VT100 Technical Manual
EK-VT100-IP	VT100 Illustrated Parts Breakdown (IPB)
MP-00633	VT100 Print Set

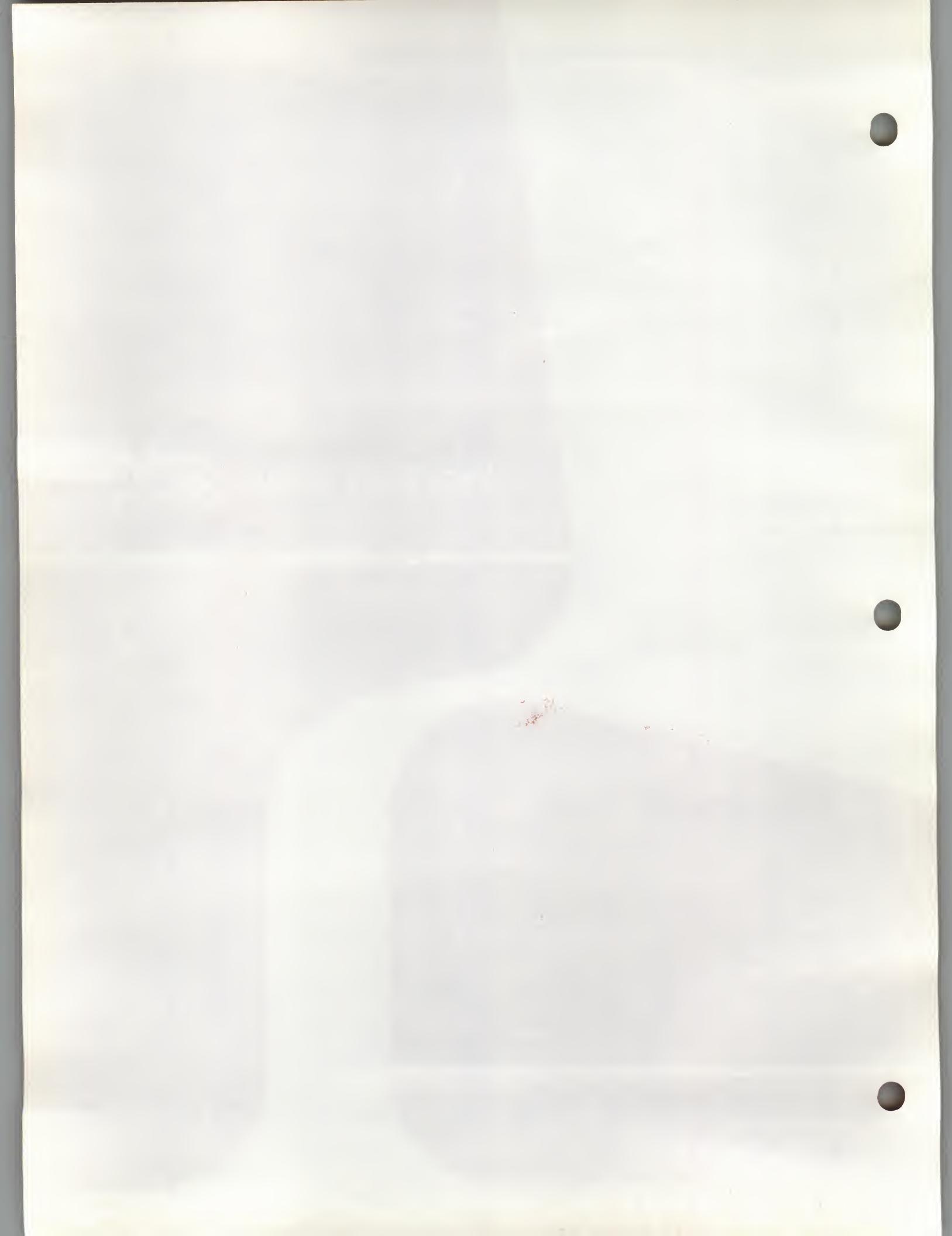
All purchase orders for hardware manuals should be forwarded to:

Digital Equipment Corporation
Cotton Road
Nashua, N.H. 03060
Supplies and Accessories Group (P086)

Purchase orders must show shipping and billing addresses and state whether a partial shipment will be accepted.

All correspondence and invoicing inquiries should be directed to the above address.

Programmer Section



CHAPTER 3

PROGRAMMER INFORMATION

The VT100 terminal normally performs a two-part function. It is an input device to a computer – information entered through the keyboard is sent to the computer. It is simultaneously an output device for the computer – that is, data coming in from the computer is displayed on the video screen. Figure 3-1 shows the data flow.

This section of the user's manual discusses data flow between the VT100 and the host. Included are the codes generated by the keyboard; the transmission protocol followed by the terminal; and the actions and reactions of the terminal to control functions in both ANSI and VT52 modes of operation.

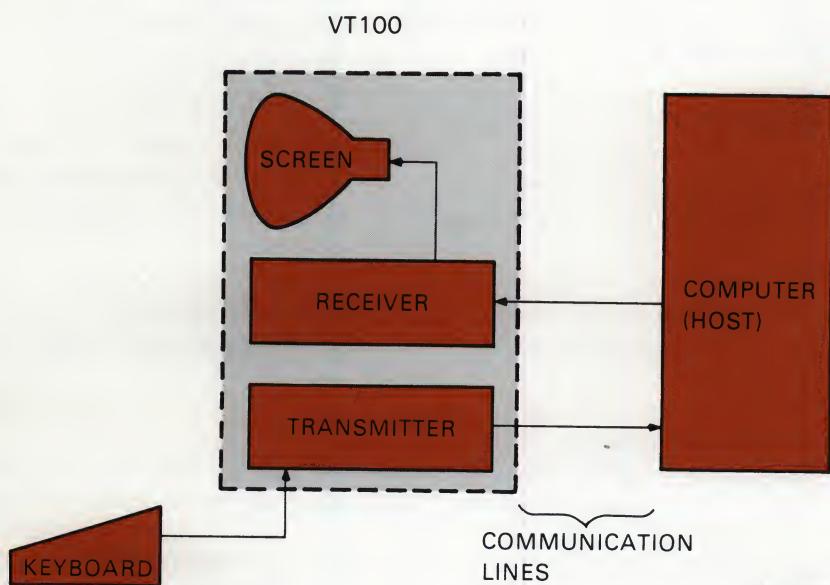


Figure 3-1
Terminal Data Flow



Figure 3-2 VT100 Keyboard

THE KEYBOARD

The VT100 uses a keyboard with a key arrangement similar to an ordinary office typewriter, as shown in Figure 3-2. In addition to the standard typewriter keys the VT100 keyboard has additional keys and indicators used to generate control sequences, cursor control commands, and to show the current terminal status.

LED Indicators

The keyboard has seven light emitting diodes (LEDs) of which two are committed to the complementary ON-LINE/LOCAL function. The power on condition is implicitly shown by one of the two LEDs being on; that is, if the keyboard is connected and power is on, one of these LEDs will be on.

A third LED indicates a "keyboard locked" condition. In this condition the keyboard has been "turned off" automatically by the terminal due to a full buffer or by the host through the transmission of an XOFF to the terminal.

The four remaining LEDs are programmable and can be assigned any meaning for specific applications. The code sequences to turn these LEDs on or off are discussed later in this chapter.

SET UP

SET-UP

The **SET-UP** key is at the upper-left corner of the main key array. Operations performed in SET-UP mode can be stored in nonvolatile memory (NVR) so that turning the terminal power off does not, by itself, alter the terminal configuration.

The procedures to change the SET-UP features are provided in the operator's information section of this manual. Those SET-UP features which may be modified by the host are listed in Table 3-1 and described in detail under the escape sequences.

Keyboard Operation

The operator uses the keyboard to transmit codes to the host. Some keys transmit one or more codes to the host immediately when typed. Other keys such as **CTRL** and **SHIFT** do not transmit codes when typed, but modify the codes transmitted by other keys. The code-transmitting keys cause the terminal to make a clicking sound to verify to the operator that the keystroke has been processed by the terminal. If two code-transmitting keys are pressed together, two codes will be transmitted according to the order in which the keys were typed. The terminal will not wait for the keys to be lifted, but will transmit both codes as soon as possible.

after the keys are first typed. If three such keys are pressed simultaneously, the codes for the first two keys are transmitted immediately; the code for the third will be transmitted when one of the first two keys is lifted.

Alphabetic Keys – The VT100 will transmit the lowercase code unless either or both of the **SHIFT** keys are down, or unless the **CAPS LOCK** key is down. Pressing the **CAPS LOCK** key will lock only the 26 alphabetic keys in the shifted (uppercase) mode. Table 3-2 shows the codes generated by the alphabetic keys.

SET-UP Feature or Machine State	Changeable from Host Computer*	Saved in NVR and Changeable in SET-UP
Alternate keypad mode	Yes (DECKPAM/DECKPNM)	No
ANSI/VT52	Yes (DECANM)	Yes
Auto Repeat	Yes (DECARM)	Yes
AUTO XON XOFF	No	Yes
Bits per character	No	Yes
Characters per line	Yes (DECCOLM)	Yes
Cursor	No	Yes
Cursor key mode	Yes (DECCKM)	No
Interlace	Yes (DECINLM)	Yes
New Line	Yes (LNM)	Yes
Keypress	No	Yes
Margin bell	No	Yes
Origin mode	Yes (DECOM)	No
Parity	No	Yes
Parity sense	No	Yes
Power	No	Yes
Receive speed	No	Yes
Screen	Yes (DECSCNM)	Yes
Scroll	Yes (DECSCLM)	Yes
Tabs	Yes (HTS/TBC)	Yes
Transmit speed	No	Yes
Wraparound	Yes (DECAWM)	Yes
# £ 3 (shifted)	Yes (SCS)	Yes

* The appropriate control or escape sequence mnemonic is indicated in parentheses.

Table 3-1
Machine States

Key	Uppercase Code (octal)	Lowercase Code (octal)	Key	Uppercase Code (octal)	Lowercase Code (octal)
A	101	141	N	116	156
B	102	142	O	117	157
C	103	143	P	120	160
D	104	144	Q	121	161
E	105	145	R	122	162
F	106	146	S	123	163
G	107	147	T	124	164
H	110	150	U	125	165
I	111	151	V	126	166
J	112	152	W	127	167
K	113	153	X	130	170
L	114	154	Y	131	171
M	115	155	Z	132	172

Table 3-2
Alphabetic Key Codes

Nonalphabetic Keys – Each of the nonalphabetic keys can be used to generate two different codes. One code will be generated if neither **SHIFT** key is pressed. The other code will be generated if either or both of the **SHIFT** keys are down. Unlike the **SHIFT LOCK** key of a typewriter, the **CAPS LOCK** key does not affect these keys; it affects only the alphabetic keys. Table 3-3 shows the nonalphabetic keys and the codes they generate.

Table 3-3
Nonalphabetic Key Codes

Lowercase Character	Neither SHIFT Key Down (Octal)	Uppercase Character	Either or Both SHIFT Keys Down (Octal)
1	061	!	041
2	062	@	100
3	063	# or £	043
4	064	\$	044
5	065	%	045
6	066	^	136
7	067	&	046
8	070	*	052
9	071	(	050
0	060	)	051
—	055	—	137
=	075	+	053
[	133	{	173
;	073	:	072
' (apostrophe)	047	"	042
, (comma)	054	<	074
. (period)	056	>	076
/	057	?	077
\	134	|	174
,	140	~	176
]	135	}	175

Function Keys – There are several keys on the keyboard which transmit control codes. Control codes do not produce displayable characters but are codes for functions. If these codes are received by the terminal, the VT100 will perform the associated function as shown in Table 3-4.

Table 3-4
Function Key Codes

Key	Octal Value of Code Sent or Received by VT100	Action The Terminal Would Take if Host Sent That Code
RETURN*	015	Carriage return function
LINEFEED	012	Line Feed
BACKSPACE	010	Backspace function
TAB	011	Tab function
SPACE BAR	040	Deposit a space on the screen erasing what was there before.
ESC	033	The initial delimiter of an escape sequence – interpret the following character string from the host as a command, rather than displaying it.
DELETE	177	Ignored by the VT100

* The **RETURN** key can be redefined so that it issues 015_8 , 012_8 , (carriage return – line feed). The New Line feature in SET-UP mode provides this capability.

NO SCROLL – When the **NO SCROLL** key is pressed it generates a single XOFF code, inhibits further scrolling and freezes the screen. When pressed again the same key generates XON. In practice, if the software recognizes XOFF, the host will stop transmitting until the **NO SCROLL** key is pressed again to allow scrolling. If the XOFF/XON feature is disabled (SET-UP function) the **NO SCROLL** key causes no action.

BREAK – Typing the **BREAK** key causes the transmission line to be forced to its zero state for 0.2333 seconds \pm 10 percent. If either **SHIFT** key is down, the time is increased to 3.5 seconds \pm 10 percent. Data Terminal Ready is also deasserted during this interval. At the conclusion of the 3.5 second interval Data Terminal Ready will again be asserted.

The **SHIFT** and **BREAK** keys typed together provide the long-break-disconnect function. Used with properly configured modems with RS-232-C levels, it will cause both the local and remote data sets to disconnect. For modems that are connected via the 20 mA current loop, issuing the long space may disconnect the remote data set only.

The **CTRL** and **BREAK** keys typed together cause the transmission of the answerback message.

The **BREAK** key does not function when the VT100 is in LOCAL mode.

Auto Repeating – All keys will auto repeat except: **SET-UP**, **ESC**, **NO SCROLL**, **TAB**, **RETURN**, and any key pressed with **CTRL**. Auto repeating works as follows: when a key is typed, its code(s) is sent once, immediately. If the key is held down for more than 1/2 second, the code(s) will be sent repeatedly at a rate of approximately 30 Hz (less if low transmit baud rates are used) until the key is released.

CTRL (Control) – The **CTRL** key is used in conjunction with other keys on the keyboard to generate control codes. If the **CTRL** key is held down when any of the keys in Table 3-5 are typed, the code actually transmitted is in the range 000_8 – 037_8 .

Key Pressed with CTRL key down (shifted or unshifted)			Key Pressed with CTRL key down (shifted or unshifted)		
	Octal Code Transmitted	Function Mnemonic		Octal Code Transmitted	Function Mnemonic
Space Bar	000	NUL	P	020	DLE
A	001	SOH	Q	021	DC1 or XON
B	002	STX	R	022	DC2
C	003	ETX	S	023	DC3 or XOFF
D	004	EOT	T	024	DC4
E	005	ENQ	U	025	NAK
F	006	ACK	V	026	SYN
G	007	BELL	W	027	ETB
H	010	BS	X	030	CAN
I	011	HT	Y	031	EM
J	012	LF	Z	032	SUB
K	013	VT	[	033	ESC
L	014	FF	\	034	FS
M	015	CR	]	035	GS
N	016	SO	~	036	RS
O	017	SI	?	037	US

Table 3-5
Control Codes Generated

Cursor Control – The keyboard also contains four keys labeled with arrows in each of four directions. These keys transmit control sequences. If the host echoes these control sequences back to the terminal, the cursor will move one character up, down, right, or left. Table 3-6 shows the control sequences generated by each key.

Table 3-6
Cursor Control Key Codes

Cursor Key (Arrow)	VT52* Mode	ANSI Mode and Cursor* Key Mode Reset	ANSI Mode and Cursor Key Mode Set
Up	ESC A	ESC [A	ESC O A
Down	ESC B	ESC [B	ESC O B
Right	ESC C	ESC [C	ESC O C
Left	ESC D	ESC [D	ESC O D

* See the control sequences section of this chapter for a complete discussion of these modes.

Auxiliary Keypad – The keys on the auxiliary keypad normally transmit the codes for the numerals, decimal point, minus sign, and comma. In addition, the key labeled **ENTER** transmits the same code as the **RETURN** key. The host cannot tell if these keys were typed on the auxiliary keypad as opposed to the corresponding keys on the main keyboard. Therefore, software which requires considerable numeric data entry need not be rewritten to use the keypad.

However, if software must be able to distinguish between pressing a key on the auxiliary keypad and pressing the corresponding key on the main keyboard, the host can give the terminal a command to place it in keypad application mode. In keypad application mode all keys on the auxiliary keypad are defined to give control sequences which may be used by the host as user-defined functions.

The codes sent by the auxiliary keypad for the four combinations of the VT52/ANSI mode and keypad numeric/application mode are shown in Tables 3-7 and 3-8. None of the keys are affected by pressing the **SHIFT**, **CAPS LOCK**, or **CTRL** keys.

Table 3-7
VT52 Mode
Auxiliary Keypad Codes

Key	Keypad Numeric Mode	Keypad Application Mode	Key	Keypad Numeric Mode	Keypad Application Mode
0	0	ESC ? p	– (dash)	– (dash)	ESC ? m
1	1	ESC ? q	, (comma)	, (comma)	ESC ? l*
2	2	ESC ? r	. (period)	. (period)	ESC ? n
3	3	ESC ? s	ENTER	Same as RETURN key	ESC ? M
4	4	ESC ? t			
5	5	ESC ? u	PF1	ESC P	ESC P
6	6	ESC ? v	PF2	ESC Q	ESC Q
7	7	ESC ? w	PF3	ESC R	ESC R
8	8	ESC ? x	PF4	ESC S	ESC S
9	9	ESC ? y			

* The last character of this escape sequence is a lowercase L (154₈).

Key	Keypad Numeric Mode	Keypad Application Mode	Key	Keypad Numeric Mode	Keypad Application Mode
0	0	ESC O p	– (dash)	– (dash)	ESC O m
1	1	ESC O q	, (comma)	, (comma)	ESC O /*
2	2	ESC O r	. (period)	. (period)	ESC O n
3	3	ESC O s	ENTER	Same as RETURN key	ESC O M
4	4	ESC O t			
5	5	ESC O u	PF1	ESC O P	ESC O P
6	6	ESC O v	PF2	ESC O Q	ESC O Q
7	7	ESC O w	PF3	ESC O R	ESC O R
8	8	ESC O x	PF4	ESC O S	ESC O S
9	9	ESC O y			

* The last character of the escape sequence is a lowercase L (154₈).

Table 3-8
ANSI Mode
Auxiliary Keypad Codes

NOTE
In ANSI mode, if the codes are echoed back to the VT100, or if the terminal is in local mode, the last character of the sequence will be displayed on the screen; e.g., PF1 will display a "P."

Special Graphics Characters

If the Special Graphics set is selected, the graphics for ASCII codes 137₈ through 176₈ will be replaced according to Table 3-9. (See the SCS control sequence.)

Octal Code	Graphic with US or UK Set	Graphic with "Special Graphics" Set	Octal Code	Graphic with US or UK Set	Graphic with "Special Graphics" Set
137	—	Blank	157	o	— Horizontal line – Scan 1
140	\	♦ Diamond	160	p	— Horizontal line – Scan 3
141	a	■■■ Checkerboard (error indicator)	161	q	— Horizontal line – Scan 5
142	b	H Horizontal tab	162	r	— Horizontal line – Scan 7
143	c	F Form Feed	163	s	— Horizontal line – Scan 9
144	d	C R Carriage return	164	t	↖ Left "T"
145	e	L F Line feed	165	u	↗ Right "T"
146	f	° Degree symbol	166	v	↙ Bottom "T"
147	g	± Plus/minus	167	w	↑ Top "T"
150	h	N L New line	170	x	| Vertical Bar
151	i	Y Vertical tab	171	y	≤ Less than or equal to
152	j	↗ Lower-right corner	172	z	≥ Greater than or equal to
153	k	↖ Upper-right corner	173	{	π Pi
154	l	↖ Upper-left corner	174	|	≠ Not equal to
155	m	↖ Lower-left corner	175	}	£ UK pound sign
156	n	+ Crossing lines	176	~	· Centered dot

Table 3-9
Special Graphics Characters

NOTE 1: Codes 152₈–156₈, 161₈, and 164₈–170₈ are used to draw rectangular grids; each piece of this line drawing set is contiguous with others so that the lines formed are unbroken.

NOTE 2: Codes 157₈–163₈ give better vertical resolution than dashes and underlines when drawing graphs; using these segments 120 X 132 resolution may be obtained in 132 column mode with the Advanced Video Option installed.

**COMMUNICATIONS
PROTOCOLS****Full Duplex**

The terminal can operate at transmission speeds up to 19,200 baud. However, the terminal may not be able to keep up with incoming data. The terminal stores incoming characters in a 64-character buffer and processes them on a first-in/first-out basis. When the content of the buffer reaches 32 characters, the terminal will transmit 023g (XOFF or DC3). On this signal the host should suspend its transmission to the terminal. Eventually, if the host stops transmitting, the terminal will deplete the buffer. When 16 characters remain in the buffer the terminal will transmit 021g (XON or DC1) to signal the host that it may resume transmission.

If the host fails to respond to an XOFF from the terminal in a timely manner, the buffer will continue to fill. When the 64-character capacity of the buffer is exceeded, a condition occurs called "buffer overflow." To determine if the buffer will overflow use the following formulas:

$$\text{No. of characters to overflow} = 32 - [3 \times (\text{receiver speed/transmit speed})]$$

$$\text{Time to respond to XOFF} = \frac{\text{No. of characters to overflow} \times (\text{bits per character} + \text{parity bit} + 2)}{\text{receiver speed}}$$

Example 1:

The VT100 is transmitting 8-bit characters with no parity at 1200 baud and receiving at 1200 baud. The terminal has just sent an XOFF which the host must respond to within 0.2416 second to avoid a buffer overflow.

$$\text{No. of characters to overflow} = 32 - [3 \times (1200/1200)] = 29 \text{ characters}$$

$$\text{Time to respond to XOFF} = \frac{29 \times (8+0+2)}{1200} = 0.2416 \text{ second}$$

Example 2:

The VT100 is transmitting 7-bit characters with parity at 300 baud and receiving at 1200 baud. The terminal has just sent an XOFF which the host must respond to within 0.1666 second to avoid a buffer overflow.

$$\text{No. of characters to overflow} = 32 - [3 \times (1200/300)] = 20 \text{ characters}$$

$$\text{Time to respond to XOFF} = \frac{20 \times (7+1+2)}{1200} = 0.1666 \text{ second}$$

If the buffer overflows, the VT100 will begin to discard incoming characters and the error character will be displayed.

Software which does not support receipt of the XOFF/XON signals from the terminal can still use the VT100 provided the software never sends the **ESC** code to the terminal, the baud rate is limited to 4800 or less, and the software does not use smooth scrolling or split screen features.

Alternatively, if XOFF/XON cannot be used, fill characters may be used after characters or character strings are sent to the VT100. A reference chart of fill characters required for these functions is included in Appendix C.

Two of the terminal functions, Reset and Self-Test, reinitialize the terminal and erase the buffer. This means that if characters are received subsequent to the

commands to perform these two functions and the characters are placed in the buffer, the character would be destroyed without being processed.

To compensate for this, the host may act in one of two ways:

1. Immediately after sending the terminal the commands to perform either the Reset or Self-Test functions, the host may act as if it had received XOFF from the terminal, thus sending no more characters until it receives XON. The terminal will transmit XON only after it completes the specified operation and the XOFF/XON feature is enabled.
2. When the first method cannot be implemented, a delay of no less than 10 seconds may be used to allow the terminal time to complete the invoked function. This method, however, does not guarantee against the loss of data when an invoked function has detected an error; and while this delay is currently adequate, future options may require a change in the time delay.

The XOFF/XON synchronization scheme has an advantage over requiring the host to insert delays or filler characters in its data stream. Requiring a minimum of software support, XON/XOFF ensures that every character or command sent to the VT100 will be processed in correct order. It frees interface programs from all timing considerations and results in more reliable operation.

In addition to the buffer-filling condition, there are two other means of transmitting XOFF and XON; the **NO SCROLL** key, and Control S/Control Q. If the XON/XOFF feature is enabled, the VT100 will coordinate these three sources of XOFF and XON so that the desired effect occurs. For example, if the buffer-filling condition has caused an XOFF to be sent, and then the operator types the **NO SCROLL** key, a second XOFF is not sent. Instead of sending an XON when the buffer empties, the VT100 waits until the operator types the **NO SCROLL** key again before sending XON.

Also, entering SET-UP mode causes the VT100 to temporarily stop taking characters from the buffer. An XOFF will be sent if the buffer becomes nearly full.

Use of Control S and Control Q will also be synchronized with the **NO SCROLL** key.

If the XON/XOFF feature is disabled, the buffer-filling condition will not send an XOFF, the **NO SCROLL** key is disabled, and Control S and Control Q will be transmitted as typed.

The VT100 also recognizes received XOFF and XON. Receipt of XOFF will inhibit the VT100 from transmitting any codes except XOFF and XON. From three to seven keystrokes on the keyboard will be stored in a keyboard buffer (some keys transmit two or three codes, e.g., cursor controls). If the keyboard buffer overflows, keyclicks will stop and the KBD LOCKED LED will come on. Transmission resumes upon receipt of XON.

If the user transmits an XOFF to the host (by Control S or **NO SCROLL**), the host should not echo any further type-in until the user types XON. This places the burden of not overloading the host's output buffer on the user.

Entering and exiting SET-UP clears the keyboard locked condition.

TERMINAL CONTROL COMMANDS The VT100 has many control commands which cause it to take action other than displaying a character on the screen. In this way, the host can command the terminal to move the cursor, change modes, ring the bell, etc. The following paragraphs discuss the terminal control commands.

Control Characters Control characters have values of 000_8 – 037_8 , and 177_8 . The control characters recognized by the VT100 are shown in Table 3-10. All other control codes cause no action to be taken.

Control characters (codes 0_8 to 37_8 inclusive) are specifically excluded from the control sequence syntax, but may be embedded within a control sequence. Embedded control characters are executed as soon as they are encountered by the VT100. The processing of the control sequence then continues with the next character received. The exceptions are: If the character **ESC** occurs, the current control sequence is aborted, and a new one commences beginning with the **ESC** just received. If the character **CAN** (30_8) or the character **SUB** (32_8) occurs, the current control sequence is aborted. The ability to embed control characters allows the synchronization characters **XON** and **XOFF** to be interpreted properly without affecting the control sequence.

Table 3-10
Control Characters

Control Character	Octal Code	Action Taken
NUL	000	Ignored on input (not stored in input buffer; see full duplex protocol).
ENQ	005	Transmit answerback message.
BEL	007	Sound bell tone from keyboard.
BS	010	Move the cursor to the left one character position, unless it is at the left margin, in which case no action occurs.
HT	011	Move the cursor to the next tab stop, or to the right margin if no further tab stops are present on the line.
LF	012	This code causes a line feed or a new line operation. (See new line mode.)
VT	013	Interpreted as LF.
FF	014	Interpreted as LF.
CR	015	Move cursor to left margin on the current line.
SO	016	Invoke G1 character set, as designated by SCS control sequence.
SI	017	Select G0 character set, as selected by ESC(sequence.
XON	021	Causes terminal to resume transmission.
XOFF	023	Causes terminal to stop transmitting all codes except XOFF and XON.
CAN	030	If sent during a control sequence, the sequence is immediately terminated and not executed. It also causes the error character to be displayed.
SUB	032	Interpreted as CAN.
ESC	033	Introduces a control sequence.
DEL	177	Ignored on input (not stored in input buffer).

The VT100 is an upward and downward software compatible terminal; that is, previous DIGITAL video terminals have DIGITAL private standards for control sequences. The American National Standards Institute (ANSI) has since standardized escape and control sequences in terminals in documents X3.41-1974 and X3.64-1977.

The VT100 is compatible with both the previous DIGITAL standard and ANSI standards. Customers may use existing DIGITAL software designed around the VT52 or new VT100 software. The VT100 has a "VT52 compatible" mode in which the VT100 responds to control sequences like a VT52. In this mode, most of the new VT100 features cannot be used.

Throughout this section of the manual, references will be made to "VT52 mode" or "ANSI mode." These two terms are used to indicate the VT100's software compatibility. All new software should be designed around the VT100 "ANSI mode." Future DIGITAL video terminals will not necessarily be committed to VT52 compatibility.

Control Sequences

NOTE

The ANSI standards allow the manufacturer flexibility in implementing each function. This manual describes how the VT100 will respond to the implemented ANSI central function.

NOTE

*ANSI standards may be obtained by writing:
Sales Department
American National Standards Institute
1430 Broadway
New York, New York 10018*

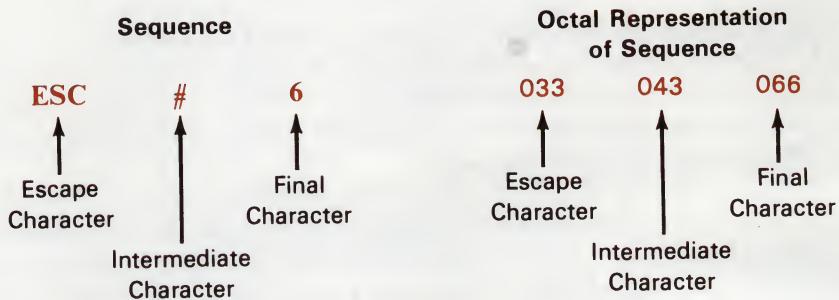
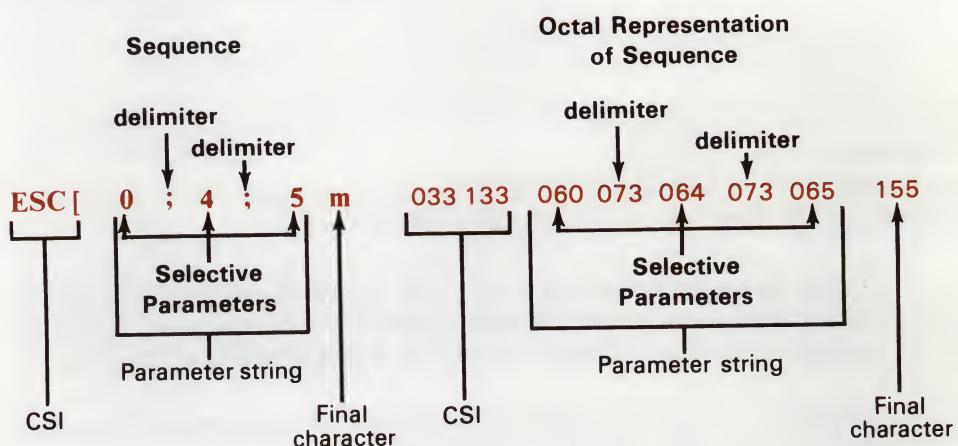
Definitions

The following listing defines the basic elements of the ANSI mode control sequences. A more complete listing appears in Appendix A.

Valid ANSI Mode Control Sequences

- Control Sequence Introducer (CSI) – An escape sequence that provides supplementary controls and is itself a prefix affecting the interpretation of a limited number of contiguous characters. In the VT100 the CSI is **ESC[**.
- Parameter – (1) A string of zero or more decimal characters which represent a single value. Leading zeros are ignored. The decimal characters have a range of 0 (60_8) to 9 (71_8). (2) The value so represented.
- Numeric Parameter – A parameter that represents a number, designated by P_n .
- Selective Parameter – A parameter that selects a subfunction from a specified list of subfunctions, designated by P_s . In general, a control sequence with more than one selective parameter causes the same effect as several control sequences, each with one selective parameter, e.g., CSI P_s ; P_s ; P_s F is identical to CSI P_s F CSI P_s F CSI P_s F.
- Parameter String – A string of parameters separated by a semicolon (73_8).
- Default – A function-dependent value that is assumed when no explicit value, or a value of 0, is specified.
- Final Character – A character whose bit combination terminates an escape or control sequence.

Examples:

1. Control sequence for double-width line (DECDWL) **ESC # 6**2. Control sequence to turn off all character attributes, and then turn on underscore and blink attributes (SGR). **ESC [0 ; 4 ; 5 m**

Alternative sequences which will accomplish the same thing:

Sequence	Octal Representation of Sequence
a. ESC [; 4 ; m	033 133 073 064 073 065 155
b. ESC [m	033 133 155
ESC [4m	033 133 064 155
ESC [5m	033 133 065 155
c. ESC [0 ; 04 ; 005 m	033 133 060 073 060 064 073 060 060 065 155

Control Sequences

All of the following escape and control sequences are transmitted from the host computer to the VT100 unless otherwise noted. All of the control sequences are a subset of those specified in ANSI X 3.64 1977 and ANSI X-3.41 1974.

Cursor Position Report — VT100 to Host**CPR****ESC [Pn; Pn R***default value: 1*

The CPR sequence reports the active position by means of the parameters. This sequence has two parameter values, the first specifying the line and the second specifying the column. The default condition with no parameters present, or parameters of 0, is equivalent to a cursor at home position.

The numbering of lines depends on the state of the Origin Mode (DECOM).

This control sequence is solicited by a device status report (DSR) sent from the host.

Cursor Backward — Host to VT100 and VT100 to Host**CUB****ESC [Pn D***default value: 1*

The CUB sequence moves the active position to the left. The distance moved is determined by the parameter. If the parameter value is zero or one, the active position is moved one position to the left. If the parameter value is n, the active position is moved n positions to the left. If an attempt is made to move the cursor to the left of the left margin, the cursor stops at the left margin. *Editor Function*

Cursor Down — Host to VT100 and VT100 to Host**CUD****ESC [Pn B***default value: 1*

The CUD sequence moves the active position downward without altering the column position. The number of lines moved is determined by the parameter. If the parameter value is zero or one, the active position is moved one line downward. If the parameter value is n, the active position is moved n lines downward. If an attempt is made to move the cursor below the bottom margin, the cursor stops at the bottom margin. *Editor Function*

Cursor Forward — Host to VT100 and VT100 to Host**CUF****ESC [Pn C***default value: 1*

The CUF sequence moves the active position to the right. The distance moved is determined by the parameter. A parameter value of zero or one moves the active position one position to the right. A parameter value of n moves the active position n positions to the right. If an attempt is made to move the cursor to the right of the right margin, the cursor stops at the right margin. *Editor Function*

Cursor Position**CUP****ESC [Pn; Pn H***default value: 1*

The CUP sequence moves the active position to the position specified by the parameters. This sequence has two parameter values, the first specifying the line

position and the second specifying the column position. A parameter value of zero or one for the first or second parameter moves the active position to the first line or column in the display, respectively. The default condition with no parameters present is equivalent to a cursor to home action. In the VT100, this control behaves identically with its format effector counterpart, HVP. *Editor Function*

The numbering of lines depends on the state of the Origin Mode (DECOM).

CUU Cursor Up — Host to VT100 and VT100 to Host

ESC [Pn A

default value: 1

Moves the active position upward without altering the column position. The number of lines moved is determined by the parameter. A parameter value of zero or one moves the active position one line upward. A parameter value of n moves the active position n lines upward. If an attempt is made to move the cursor above the top margin, the cursor stops at the top margin. *Editor Function*

DA Device Attributes

ESC [Pn c

default value: 0

1. The host requests the VT100 to send a device attributes (DA) control sequence to identify itself by sending the DA control sequence with either no parameter or a parameter of 0.
2. Response to the request described above (VT100 to host) is generated by the VT100 as a DA control sequence with the numeric parameters as follows:

Option Present	Sequence Sent
No options	ESC [?1;0c
Processor option (STP)	ESC [?1;1c
Advanced video option (AVO)	ESC [?1;2c
AVO and STP	ESC [?1;3c
Graphics option (GPO)	ESC [?1;4c
GPO and STP	ESC [?1;5c
GPO and AVO	ESC [?1;6c
GPO, STP, and AVO	ESC [?1;7c

DECALN Screen Alignment Display (DEC Private)

ESC # 8

This command fills the entire screen area with uppercase Es for screen focus and alignment. This command is used by DEC manufacturing and Field Service personnel.

DECANM ANSI/VT52 Mode (DEC Private)

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences. The reset state causes only VT52 compatible escape sequences to be interpreted and executed. The set state causes only ANSI "compatible" escape and control sequences to be interpreted and executed.

Auto Repeat Mode (DEC Private)**DECARM**

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences. The reset state causes no keyboard keys to auto-repeat. The set state causes certain keyboard keys to auto-repeat.

Autowrap Mode (DEC Private)**DECAWM**

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences. The reset state causes any displayable characters received when the cursor is at the right margin to replace any previous characters there. The set state causes these characters to advance to the start of the next line, doing a scroll up if required and permitted.

Cursor Keys Mode (DEC Private)**DECCKM**

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences. This mode is only effective when the terminal is in keypad application mode (see DECKPAM) and the ANSI/VT52 mode (DECANM) is set (see DECANM). Under these conditions, if the cursor key mode is reset, the four cursor function keys will send ANSI cursor control commands. If cursor key mode is set, the four cursor function keys will send application functions.

Column Mode (DEC Private)**DECCOLM**

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences. The reset state causes a maximum of 80 columns on the screen. The set state causes a maximum of 132 columns on the screen.

Double Height Line (DEC Private)**DEC DHL**

Top Half: **ESC # 3**

Bottom Half: **ESC # 4**

These sequences cause the line containing the active position to become the top or bottom half of a double-height double-width line. The sequences must be used in pairs on adjacent lines and the same character output must be sent to both lines to form full double-height characters. If the line was single-width single-height, all characters to the right of the center of the screen are lost. The cursor remains over the same character position unless it would be to the right of the right margin, in which case it is moved to the right margin.

NOTE

The use of double-width characters reduces the number of characters per line by half.

Double-Width Line (DEC Private)**DECDWL**

ESC # 6

This causes the line that contains the active position to become double-width single-height. If the line was single-width single-height, all characters to the right of the screen are lost. The cursor remains over the same character position unless it would be to the right of the right margin, in which case, it is moved to the right margin.

NOTE

The use of double-width characters reduces the number of characters per line by half.

DECID Identify Terminal (DEC Private)**ESC Z**

This sequence causes the same response as the ANSI device attributes (DA). This sequence will not be supported in future DEC terminals, therefore, DA should be used by any new software.

DECINLM Interlace Mode (DEC Private)

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences. The reset state (non-interlace) causes the video processor to display 240 scan lines per frame. The set state (interlace) causes the video processor to display 480 scan lines per frame. There is no increase in character resolution.

DECKPAM Keypad Application Mode (DEC Private)**ESC =**

The auxiliary keypad keys will transmit control sequences as defined in Tables 3-7 and 3-8.

DECKPNM Keypad Numeric Mode (DEC Private)**ESC >**

The auxiliary keypad keys will send ASCII codes corresponding to the characters engraved on the keys.

DECLL Load LEDs (DEC Private)**ESC [Ps q***default value: 0*

Load the four programmable LEDs on the keyboard according to the parameter(s).

Parameter	Parameter Meaning
0	Clear LEDs L1 through L4
1	Light L1
2	Light L2
3	Light L3
4	Light L4

LED numbers are indicated on the keyboard.

DECOM Origin Mode (DEC Private)

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences. The reset state causes the origin to be at the upper-left character position on the screen. Line and column numbers are, therefore, independent of current margin settings. The cursor may be positioned outside the margins with a cursor position (CUP) or horizontal and vertical position (HVP) control.

The set state causes the origin to be at the upper-left character position within the margins. Line and column numbers are therefore relative to the current margin settings. The cursor is not allowed to be positioned outside the margins.

The cursor is moved to the new home position when this mode is set or reset.

Lines and columns are numbered consecutively, with the origin being line 1, column 1.

Restore Cursor (DEC Private)

DECRC

ESC 8

This sequence causes the previously saved cursor position, graphic rendition, and character set to be restored.

Report Terminal Parameters

DECREPTPARM

ESC [<sol>; <par>; <nbits>; <xspeed>; <rspeed>; <clkmul>; <flags>x

These sequence parameters are explained below in the DECREQTPARM sequence.

Request Terminal Parameters

DECREQTPARM

ESC [<sol> x

The sequence DECREPTPARM is sent by the terminal controller to notify the host of the status of selected terminal parameters. The status sequence may be sent when requested by the host or at the terminal's discretion. DECREPTPARM is sent upon receipt of a DECREQTPARM. On power-up or reset, the VT100 is inhibited from sending unsolicited reports.

The meanings of the sequence parameters are:

Parameter	Value	Meaning
<sol>	0 or none	This message is a request (DECREQTPARM) and the terminal will be allowed to send unsolicited reports. (Unsolicited reports are sent when the terminal exits the SET-UP mode.)
	1	This message is a request; from now on the terminal may only report in response to a request.
	2	This message is a report (DECREPTPARM).
	3	This message is a report and the terminal is only reporting on request.
<par>	1	No parity set
	4	Parity is set and odd
	5	Parity is set and even
<nbits>	1	8 bits per character
	2	7 bits per character

Parameter	Value	Meaning
$\langle xspeed \rangle, \langle rspeed \rangle$	0 8 16 24 32 40 48 56 64 72 80 88 96 104 112 120	50 75 110 134.5 150 200 300 600 1200 1800 2000 2400 3600 4800 9600 19200
$\langle clkmul \rangle$	1	The bit rate multiplier is 16.
$\langle flags \rangle$	0-15	This value communicates the four switch values in block 5 of SET UP B, which are only visible to the user when an STP option is installed. These bits may be assigned for an STP device. The four bits are a decimal-encoded binary number.

DECSC Save Cursor (DEC Private)**ESC 7**

This sequence causes the cursor position, graphic rendition, and character set to be saved. (See DECRC.)

DECSCLM Scrolling Mode (DEC Private)

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences. The reset state causes scrolls to "jump" instantaneously. The set state causes scrolls to be "smooth" at a maximum rate of six lines per second.

DECSCNM Screen Mode (DEC Private)

This is a private parameter applicable to set mode (SM) and reset mode (RM) control sequences. The reset state causes the screen to be black with white characters. The set state causes the screen to be white with black characters.

DECSTBM Set Top and Bottom Margins (DEC Private)**ESC [Pn; Pn r***default values: see below*

This sequence sets the top and bottom margins to define the scrolling region. The first parameter is the line number of the first line in the scrolling region; the second parameter is the line number of the bottom line in the scrolling region. Default is the entire screen (no margins). The minimum size of the scrolling region allowed is two lines, i.e., the top margin must be less than the bottom margin. The cursor is placed in the home position (see Origin Mode DECOM).

Single-width Line (DEC Private)**DECSWL****ESC # 5**

This causes the line which contains the active position to become single-width single-height. The cursor remains on the same character position. This is the default condition for all new lines on the screen.

Invoke Confidence Test**DECTST****ESC [2 ; Ps y**

Ps is the parameter indicating the test to be done. Ps is computed by taking the weight indicated for each desired test and adding them together. If Ps is 0, no test is performed but the VT100 is reset.

Test	Weight
Power up self-test (ROM check sum, RAM, NVR keyboard and AVO if installed)	1
Data Loop Back	2 (loop back connector required)
EIA modem control test	4 (loop back connector required)
Repeat Selected Test(s) indefinitely (until failure or power off)	8

Device Status Report**DSR****ESC [Ps n***default value: 0*

Requests and reports the general status of the VT100 according to the following parameter(s).

Parameter Parameter Meaning

0	Response from VT100 – Ready, No malfunctions detected (default)
3	Response from VT100 – Malfunction – retry
5	Command from host – Please report status (using a DSR control sequence)
6	Command from host – Please report active position (using a CPR control sequence)

DSR with a parameter value of 0 or 3 is always sent as a response to a requesting DSR with a parameter value of 5.

ED Erase In Display**ESC [Ps J***default value: 0*

This sequence erases some or all of the characters in the display according to the parameter. Any complete line erased by this sequence will return that line to single width mode. *Editor Function*

Parameter	Parameter Meaning
-----------	-------------------

0	Erase from the active position to the end of the screen, inclusive (default)
1	Erase from start of the screen to the active position, inclusive
2	Erase all of the display – all lines are erased, changed to single-width, and the cursor does not move.

EL Erase In Line**ESC [Ps K***default value: 0*

Erases some or all characters in the active line according to the parameter. *Editor Function*

Parameter	Parameter Meaning
-----------	-------------------

0	Erase from the active position to the end of the line, inclusive (default)
1	Erase from the start of the screen to the active position, inclusive
2	Erase all of the line, inclusive

HTS Horizontal Tabulation Set**ESC H**

Set one horizontal stop at the active position. *Format Effector*

HVP Horizontal and Vertical Position**ESC [Pn ; Pn f***default value: 1*

Moves the active position to the position specified by the parameters. This sequence has two parameter values, the first specifying the line position and the second specifying the column. A parameter value of either zero or one causes the active position to move to the first line or column in the display, respectively. The default condition with no parameters present moves the active position to the

home position. In the VT100, this control behaves identically with its editor function counterpart, CUP. The numbering of lines and columns depends on the reset or set state of the origin mode (DECOM). *Format Effector*

Index

IND

ESC D

This sequence causes the active position to move downward one line without changing the column position. If the active position is at the bottom margin, a scroll up is performed. *Format Effector*

Line Feed/New Line Mode

LNM

This is a parameter applicable to set mode (SM) and reset mode (RM) control sequences. The reset state causes the interpretation of the line feed (LF), defined in ANSI Standard X3.4-1977, to imply only vertical movement of the active position and causes the **RETURN** key (CR) to send the single code CR. The set state causes the LF to imply movement to the first position of the following line and causes the **RETURN** key to send the two codes (CR, LF). This is the New Line (NL) option.

This mode does not affect the index (IND), or next line (NEL) format effectors.

Next Line

NEL

ESC E

This sequence causes the active position to move to the first position on the next line downward. If the active position is at the bottom margin, a scroll up is performed. *Format Effector*

Reverse Index

RI

ESC M

Move the active position to the same horizontal position on the preceding line. If the active position is at the top margin, a scroll down is performed. *Format Effector*

Reset To Initial State

RIS

ESC c

Reset the VT100 to its initial state, i.e., the state it has after it is powered on. This also causes the execution of the power-up self-test and signal INIT H to be asserted briefly.

Reset Mode

RM

ESC [Ps ;Ps ; . . . ; Ps /

default value: none

Resets one or more VT100 modes as specified by each selective parameter in the parameter string. Each mode to be reset is specified by a separate parameter. [See Set Mode (SM) control sequence.] (See Modes following this section.)

SCS Select Character Set

The appropriate G0 and G1 character sets are designated from one of the five possible character sets. The G0 and G1 sets are invoked by the codes SI and SO (shift in and shift out) respectively.

G0 Sets Sequence	G1 Sets Sequence	Meaning
ESC (A	ESC) A	United Kingdom Set
ESC (B	ESC) B	ASCII Set
ESC (0	ESC) 0	Special Graphics
ESC (1	ESC) 1	Alternate Character ROM Standard Character Set
ESC (2	ESC) 2	Alternate Character ROM Special Graphics

NOTE

Additional information concerning the SCS escape sequence may be obtained in ANSI standard X3.41-1974.

The United Kingdom and ASCII sets conform to the "ISO international register of character sets to be used with escape sequences." The other sets are private character sets. Special graphics means that the graphic characters for the codes 1378 to 1768 are replaced with other characters. The specified character set will be used until another SCS is received.

SGR Select Graphic Rendition**ESC [Ps; ... ; Ps m***default value: 0*

Invoke the graphic rendition specified by the parameter(s). All following characters transmitted to the VT100 are rendered according to the parameter(s) until the next occurrence of SGR. *Format Effector*

Parameter	Parameter Meaning
0	Attributes off
1	Bold or increased intensity
4	Underscore
5	Blink
7	Negative (reverse) image

All other parameter values are ignored.

Without the Advanced Video Option, only one type of character attribute is possible as determined by the cursor selection; in that case specifying either the underscore or the reverse attribute will activate the currently selected attribute. (See cursor selection in Chapter 1.)

SM Set Mode**ESC Ps; ... ; Ps h***default value: none*

Causes one or more modes to be set within the VT100 as specified by each selective parameter in the parameter string. Each mode to be set is specified by a separate parameter. A mode is considered set until it is reset by a reset mode (RM) control sequence.

Tabulation Clear**ESC [Ps g****TBC***default value: 0***Parameter Parameter Meaning**

0 Clear the horizontal tab stop at the active position (the default case).
 3 Clear all horizontal tab stops.

Any other parameter values are ignored. *Format Effector*

The following is a list of VT100 modes which may be changed with set mode (SM) and reset mode (RM) controls.

MODES**ANSI Specified Modes**

Parameter	Mode Mnemonic	Mode Function
0		Error (ignored)
20	LNM	Line feed new line mode

DEC Private Modes

If the first character in the parameter string is ? (77₈), the parameters are interpreted as DEC private parameters according to the following:

Parameter	Mode Mnemonic	Mode Function
0		Error (ignored)
1	DECCKM	Cursor key
2	DECANM	ANSI/VT52
3	DECCOLM	Column
4	DECSCLM	Scrolling
5	DECSCNM	Screen
6	DECOM	Origin
7	DECAWM	Auto wrap
8	DECARM	Auto repeating
9	DECINLM	Interlace

Any other parameter values are ignored.

The following modes, which are specified in the ANSI X3.64-1977 standard, may be considered to be permanently set, permanently reset, or not applicable, as noted. Refer to that standard for further information concerning these modes.

Mode Mnemonic	Mode Function	State
CRM	Control representation	Reset
EBM	Editing boundary	Reset
ERM	Erasure	Set
FEAM	Format effector action	Reset
FETM	Format effector transfer	Reset

Mode Mnemonic	Mode Function	State
GATM	Guarded area transfer	NA
HEM	Horizontal editing	NA
IRM	Insertion-replacement	Reset
KAM	Keyboard action	Reset
MATM	Multiple area transfer	NA
PUM	Positioning unit	Reset
SATM	Selected area transfer	NA
SRTM	Status reporting transfer	Reset
TSM	Tabulation stop	Reset
TTM	Transfer termination	NA
VEM	Vertical editing	NA

**Valid VT52
Mode Control
Sequences**

Cursor Up

ESC A

Move the active position upward one position without altering the horizontal position. If an attempt is made to move the cursor above the top margin, the cursor stops at the top margin.

Cursor Down

ESC B

Move the active position downward one position without altering the horizontal position. If an attempt is made to move the cursor below the bottom margin, the cursor stops at the bottom margin.

Cursor Right

ESC C

Move the active position to the right. If an attempt is made to move the cursor to the right of the right margin, the cursor stops at the right margin.

Cursor Left

ESC D

Move the active position one position to the left. If an attempt is made to move the cursor to the left of the left margin, the cursor stops at the left margin.

NOTE Enter Graphics Mode

The special graphics characters in the VT100 are different from those in the VT52.

ESC F

Causes the special graphics character set to be used.

Exit Graphics Mode**ESC G**

This sequence causes the standard ASCII character set to be used.

Cursor to Home**ESC H**

Move the cursor to the home position.

Reverse Line Feed**ESC I**

Move the active position upward one position without altering the column position. If the active position is at the top margin, a scroll down is performed.

Erase to End of Screen**ESC J**

Erase all characters from the active position to the end of the screen. The active position is not changed.

Erase to End of Line**ESC K**

Erase all characters from the active position to the end of the current line. The active position is not changed.

Direct Cursor Address**ESC Y line column**

Move the cursor to the specified line and column. The line and column numbers are sent as ASCII codes whose values are the number plus 037₈; e.g., 040₈ refers to the first line or column, 050₈ refers to the eighth line or column, etc.

Identify**ESC Z**

This sequence causes the terminal to send its identifier escape sequence to the host. This sequence is:

ESC / Z.**Enter Alternate Keypad Mode****ESC =**

The optional auxiliary keypad keys will send unique identifiable escape sequences for use by applications programs.

NOTE

Information regarding options must be obtained in ANSI mode, using the device attributes (DA) control sequence.

Exit Alternate Keypad Mode**ESC >**

The optional auxiliary keypad keys send the ASCII codes for the functions or characters engraved on the key.

Enter ANSI Mode**ESC <**

All subsequent escape sequences will be interpreted according to ANSI Standards X3.64-1977 and X3.41-1974. The VT52 escape sequence designed in this section will not be recognized.

Control Sequence

Summary The following is a summary of the VT100 control sequences.

ANSI Compatible Mode**Cursor Movement Commands**

Cursor up	ESC [Pn A
Cursor down	ESC [Pn B
Cursor forward (right)	ESC [Pn C
Cursor backward (left)	ESC [Pn D
Direct cursor addressing	ESC [Pl; Pc H † or ESC [Pl; Pc f †
Index	ESC D
New line	ESC E
Reverse index	ESC M
Save cursor and attributes	ESC 7
Restore cursor and attributes	ESC 8

†Pl = line number; Pc = column number.

NOTE
Pn refers to a decimal parameter expressed as a string of ASCII digits. Multiple parameters are separated by the semicolon character (0738). If a parameter is omitted or specified to be 0 the default parameter value is used. For the cursor movement commands, the default parameter value is 1.

Line Size (Double-Height and Double-Width) Commands

Change this line to double-height top half	ESC #3
Change this line to double-height bottom half	ESC #4
Change this line to single-width single-height	ESC #5
Change this line to double-width single-height	ESC #6

Character Attributes**ESC [Ps;Ps;Ps;...;Ps m**

Ps refers to a selective parameter. Multiple parameters are separated by the semicolon character (0738). The parameters are executed in order and have the following meanings:

0 or None	All Attributes Off
1	Bold on
4	Underscore on
5	Blink on
7	Reverse video on

Any other parameter values are ignored.

Erasing

From cursor to end of line	ESC [K or ESC [0 K
From beginning of line to cursor	ESC [1 K
Entire line containing cursor	ESC [2 K
From cursor to end of screen	ESC [J or ESC [0 J
From beginning of screen to cursor	ESC [1 J
Entire screen	ESC [2 J

Programmable LEDs**ESC [Ps;Ps;...Ps q**

Ps are selective parameters separated by semicolons (073g) and executed in order, as follows:

0 or None	All LEDs Off
1	L1 On
2	L2 On
3	L3 On
4	L4 On

Any other parameter values are ignored.

Character Sets (G0 and G1 Designators)

The G0 and G1 character sets are designated as follows:

Character set	G0 designator	G1 designator
United Kingdom (UK)	ESC (A	ESC) A
United States (USASCII)	ESC (B	ESC) B
Special graphics characters and line drawing set	ESC (0	ESC) 0
Alternate character ROM	ESC (1	ESC) 1
Alternate character ROM special graphics characters	ESC (2	ESC) 2

Scrolling Region**ESC [Pt ; Pb r**

Pt is the number of the top line of the scrolling region; Pb is the number of the bottom line of the scrolling region and must be greater than Pt.

Tab Stops:

Set tab at current column	ESC H
Clear tab at current column	ESC [g or ESC [0 g
Clear all tabs	ESC [3 g

Modes

Mode Name	Mode	To Set Sequence	Mode	To Reset Sequence
Line feed/new line	New line	ESC [20h	Line feed	ESC [20/*
Cursor key mode	Application	ESC [?1h	Cursor	ESC [?1/*
ANSI/VT52 mode	ANSI	<i>N/A</i>	VT52	ESC [?2/*
Column mode	132 Col	ESC [?3h	80 Col	ESC [?3/*
Scrolling mode	Smooth	ESC [?4h	Jump	ESC [?4/*
Screen mode	Reverse	ESC [?5h	Normal	ESC [?5/*
Origin mode	Relative	ESC [?6h	Absolute	ESC [?6/*
Wraparound	On	ESC [?7h	Off	ESC [?7/*
Auto repeat	On	ESC [?8h	Off	ESC [?8/*
Interlace	On	ESC [?9h	Off	ESC [?9/*
Keypad mode	Application	ESC =	Numeric	ESC >

* The last character of the sequence is a lowercase L (154₈).

Reports**Cursor Position Report**

Invoked by **ESC [6 n**
 Response is **ESC [Pl ; Pc R**†

†Pl = line number; Pc = column number.

Status Report

Invoked by **ESC [5 n**
 Response is **ESC [0 n** (terminal ok)
ESC [3 n (terminal not ok)

What Are You

Invoked by **ESC [c**
 or
ESC [0 c
 Response is **ESC [?1 ; Ps c**

Ps is the "option present" parameter with the following meaning:

Ps	Meaning
0	Base VT100, no options
1	Processor option (STP)
2	Advanced video option (AVO)
3	AVO and STP
4	Graphics processor option (GPO)
5	GPO and STP
6	GPO and AVO
7	GPO, STP, and AVO

Alternately invoked by **ESC Z** (not recommended). Response is the same.

Reset

Reset causes the power-up reset routine to be executed.

ESC c**Confidence Tests**

Fill Screen with "Es"
Invoke Test(s)

ESC # 8
ESC [2 ; Ps y

Ps is the parameter indicating the test to be done and is a decimal number computed by taking the "weight" indicated for each desired test and adding them together.

Test	Weight
Power-up self test (ROM checksum, RAM, NVR, keyboard and AVO if installed)	1
Data Loop Back	2 (loop back connector required)
EIA modem control test	4 (loop back connector required)
Repeat selected test(s) indefinitely (until failure or power off)	8

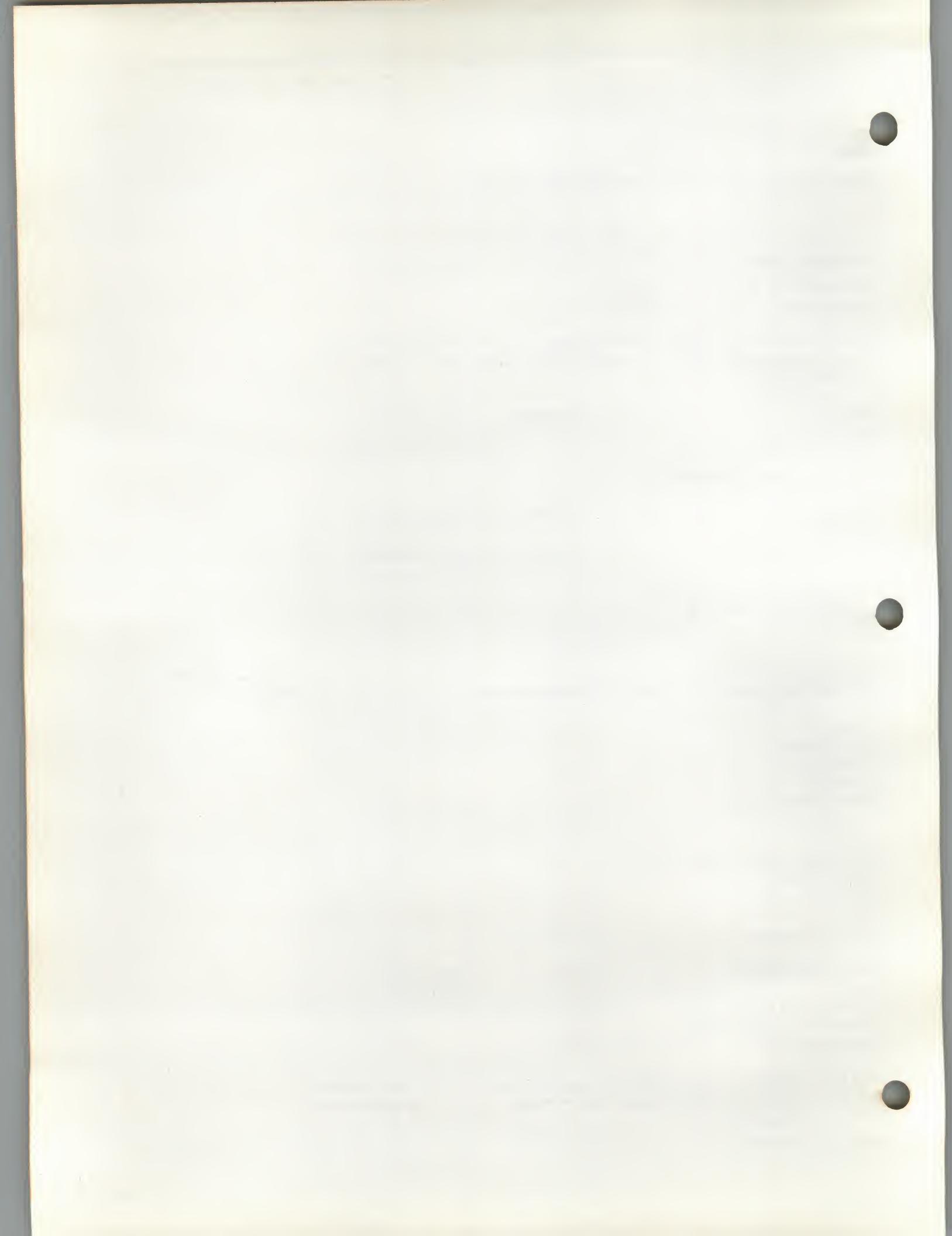
The following is a summary of the VT100 control sequences.

**VT52 Compatible
Mode**

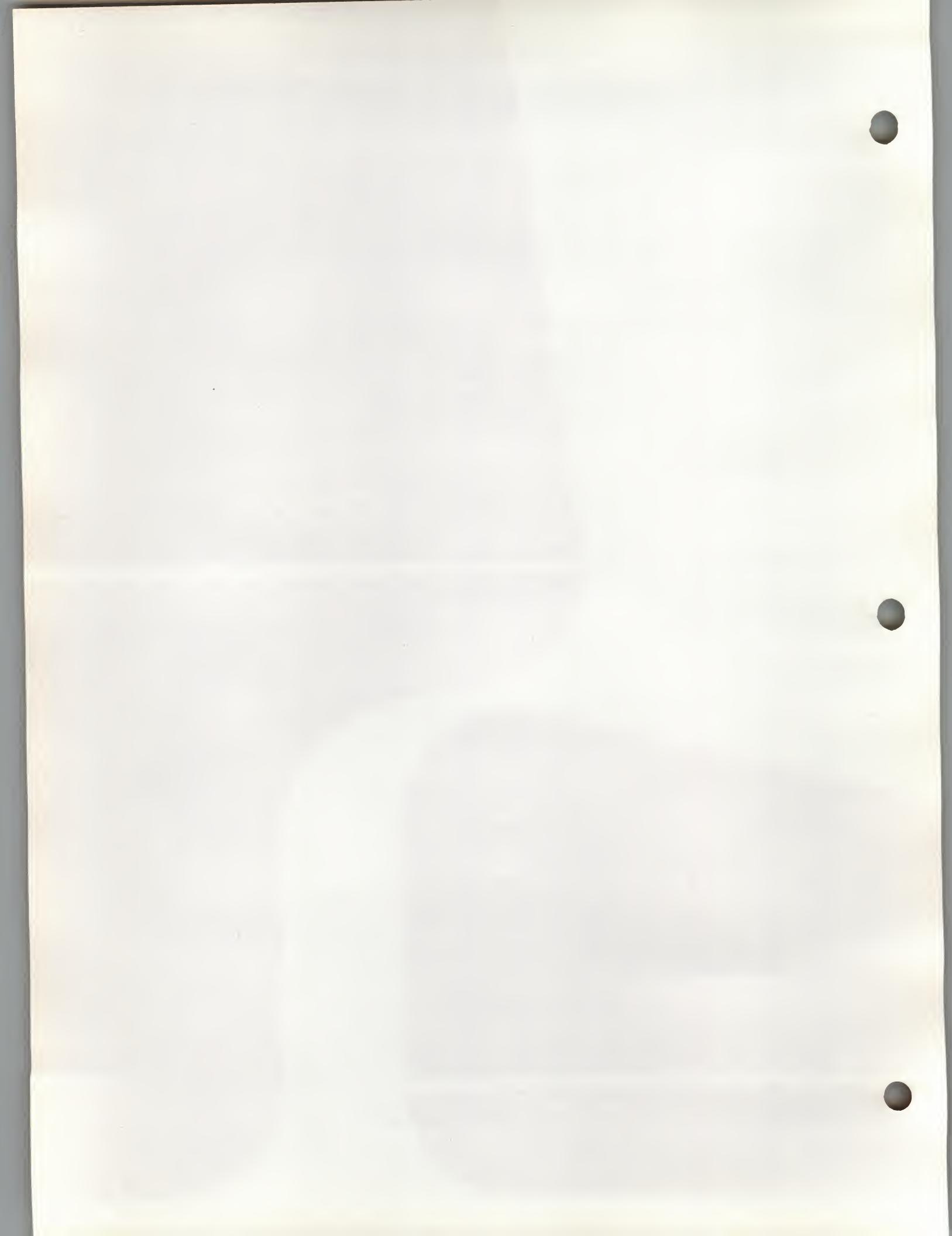
Cursor Up	ESC A
Cursor Down	ESC B
Cursor Right	ESC C
Cursor Left	ESC D
Select Special Graphics character set	ESC F
Select ASCII character set	ESC G
Cursor to home	ESC H
Reverse line feed	ESC I
Erase to end of screen	ESC J
Erase to end of line	ESC K
Direct cursor address	ESC Ylc
Identify	ESC Z
Enter alternate keypad mode	ESC =
Exit alternate keypad mode	ESC >
Enter ANSI mode	ESC <

NOTE 1: Line and column numbers for direct cursor address are single character codes whose values are the desired number plus 37₈. Line and column numbers start at 1.

NOTE 2: Response to **ESC Z** is **ESC / Z**



Options



CHAPTER 4

VT100 OPTIONS

The VT100 has available options which are designed to enhance the basic terminal and allow its use in a wide range of applications. The options currently available are:

VT1XX-AA 20 mA Current Loop Option
VT1XX-AB Advanced Video Option

In the future, additional options will be available which will further enhance the basic VT100. Contact the nearest DIGITAL Sales Office for further information and how to order the options.

ADVANCED VIDEO OPTION – VT1XX-AB

The Advanced Video Option enhances the basic VT100 by adding the following features:

- 10 additional lines of 132 column display – this capability is added to the VT100 by providing additional display memory. The screen can now display a total of 24 lines in either 80- or 132-column format.
- Additional character attributes – the VT100 is now capable of highlighting any character(s) on the screen in any of the following ways:

 Bold
 Blink
 Underline
 Reverse
 Any combination of the above

- Capability of an additional character generator ROM – this capability is added to the VT100 by providing the memory required to access a second character generator ROM.

Advanced Video Option Installation

Use the following procedure to install the Advanced Video Option.

1. Remove power from the terminal by disconnecting the ac plug.
2. Unplug the keyboard (Figure 4-1).
3. Unplug any connectors from the composite video input/output jacks.
4. Disconnect the communications cable.
5. With a blade-type screwdriver loosen the four captive screws holding the access cover.
6. If the 20 mA Current Loop Option is installed, gently pull the access cover away from the terminal about 2 inches; then reach in and disconnect J5 from the terminal controller board.
7. Remove the access cover.
8. Remove any graphic or STP cables.
9. Remove the terminal controller board by gently but firmly pulling the board straight out. The terminal controller board is located in the leftmost slot in the card cage (viewed from the rear).
10. Place the terminal controller board on a flat surface with the component side up (Figure 4-2).
11. Locate the four mounting holes drilled in the terminal controller board; mount a standoff in each.
12. Grasp the advanced video board by the edges and carefully align the connector pins with the connector on the terminal controller board. Gently but firmly mount the advanced video board onto the terminal controller board.
13. Reinstall the terminal controller board. The terminal controller board must be inserted into the leftmost slot in the card cage.
14. Reinstall all cables removed.
15. Reinstall the access cover.

Advanced Video Option Checkout

Use the following procedure to check out the operation of the Advanced Video Option.

1. Turn the terminal power on and verify that no error was detected during the power up self-test.
2. Press the **SET-UP** key. The words "SET-UP A" should blink in boldface, the words "TO EXIT PRESS SET-UP" should be underlined, and the ruler should contain alternating normal and reverse video fields.
3. Place the terminal in the 132-column mode and then in the LOCAL mode.
4. Exit SET-UP and type the following sequence:

ESC < ESC # 8

The screen should now display 24 lines X 132 columns.

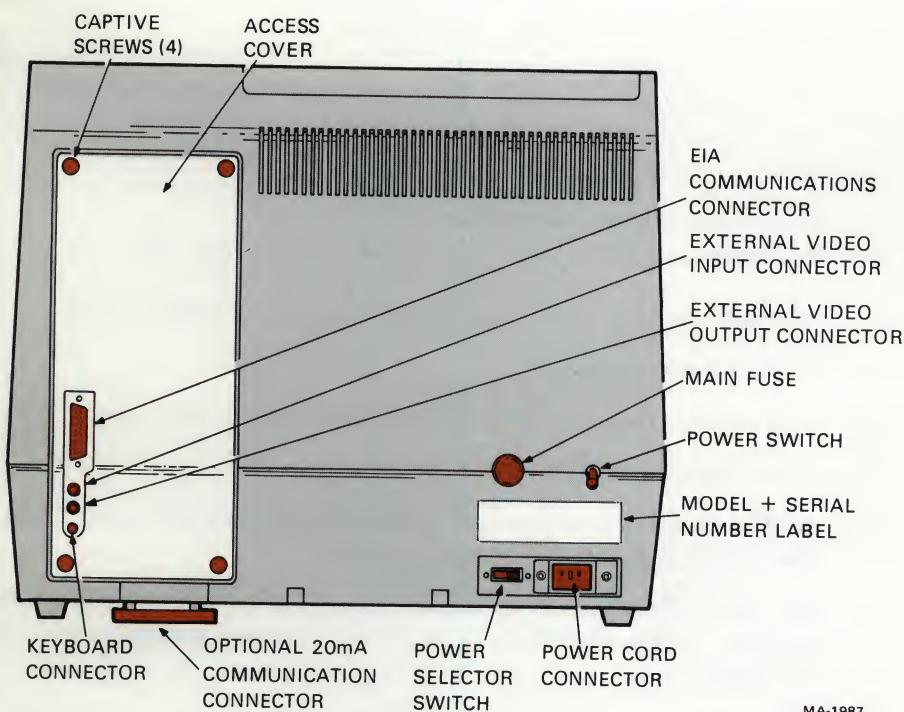


Figure 4-1
VT100 Rear View

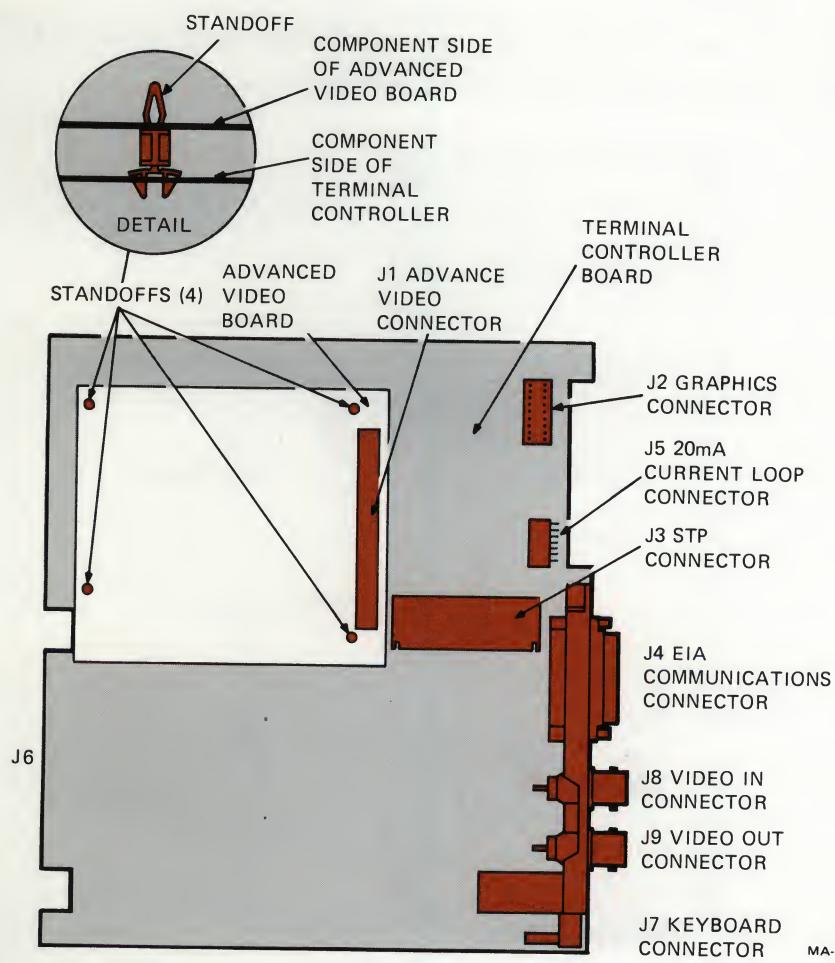


Figure 4-2
Advanced Video Option
Installation

20 mA CURRENT LOOP OPTION – VT1XX-AA

The 20 mA Current Loop Option allows the VT100 to connect directly to the host computer over a short distance without using a modem. The specifications for the 20 mA Current Loop Option are located in Chapter 2 of this manual under interface information.

20 mA Current Loop Option Installation

Use the following procedure to install the 20 mA Current Loop Option:

1. Remove power from the terminal by disconnecting the ac plug.
2. Unplug the keyboard.
3. Unplug any connectors from the composite video input/output jacks.
4. Disconnect the communications cable.
5. With a blade-type screwdriver loosen the four captive screws holding the access cover; then remove the cover.
6. Set the TRANS switch to the NORMAL position (Figure 4-3). (If the terminal must provide current on the receive line, set the switch to the ACT position.)
7. Set the REC switch to the NORMAL position (Figure 4-3). (If the terminal must provide current on the receive line set the switch to the ACT position.)
8. Connect P5 to J5 on the terminal controller board (Figure 4-4).
9. Perform the 20 mA Current Loop Option Checkout.

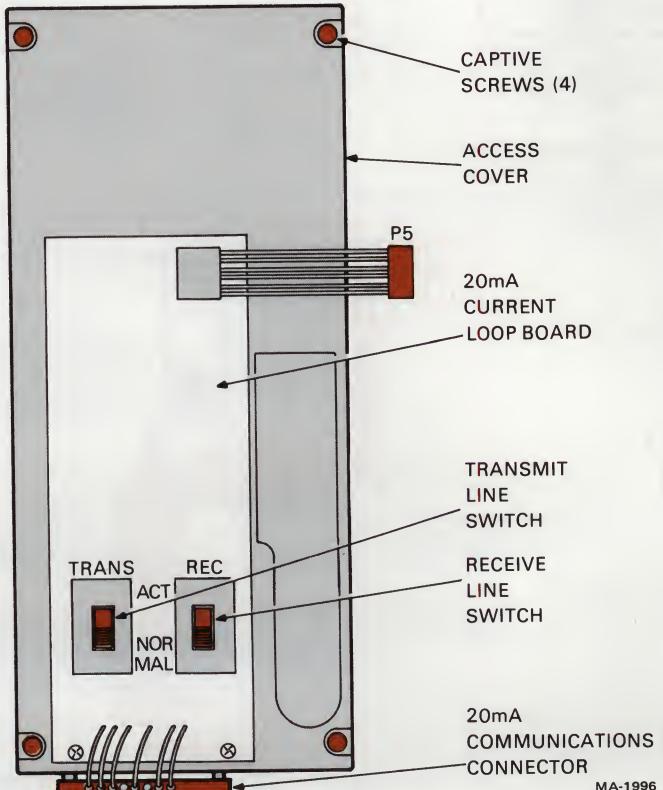


Figure 4-3
20 mA Current Loop Option

MA-1996

20 mA Current Loop Option Checkout

The VT100 contains an internal test called the data loopback test. In the data loopback test the VT100 transmit and receive lines are connected to each other via a special external connector. A predefined set of characters are then transmitted. The terminal receives the characters and compares them to the characters transmitted. If the characters do not match an error is then flagged.

Use the following procedure to check out the operation of the 20 mA Current Loop Option.

1. Disconnect the terminal from the communications line.
2. Remove the terminal access cover containing the 20 mA current loop board; place both of the switches in the NORMAL position. Reinstall the access cover.
3. Connect the 20 mA loopback connector (PN 70-15503-00) to the Mate-N-Lok connector mounted to the bottom of the access cover.
4. Place the terminal in ANSI-compatible mode (in SET-UP B group 2 switch 3 equals a 1).
5. Type the following sequence to perform the data loopback test.

ESC [2; 2 y

When the test is performed, the screen clears and the message "WAIT" is displayed in the upper left corner of the screen. The entire test takes approximately six seconds to run.

NOTE

*The data loopback test can be repeated indefinitely by typing **ESC [2; 10 y**. This test ends only when an error is detected or the terminal power is turned off.*

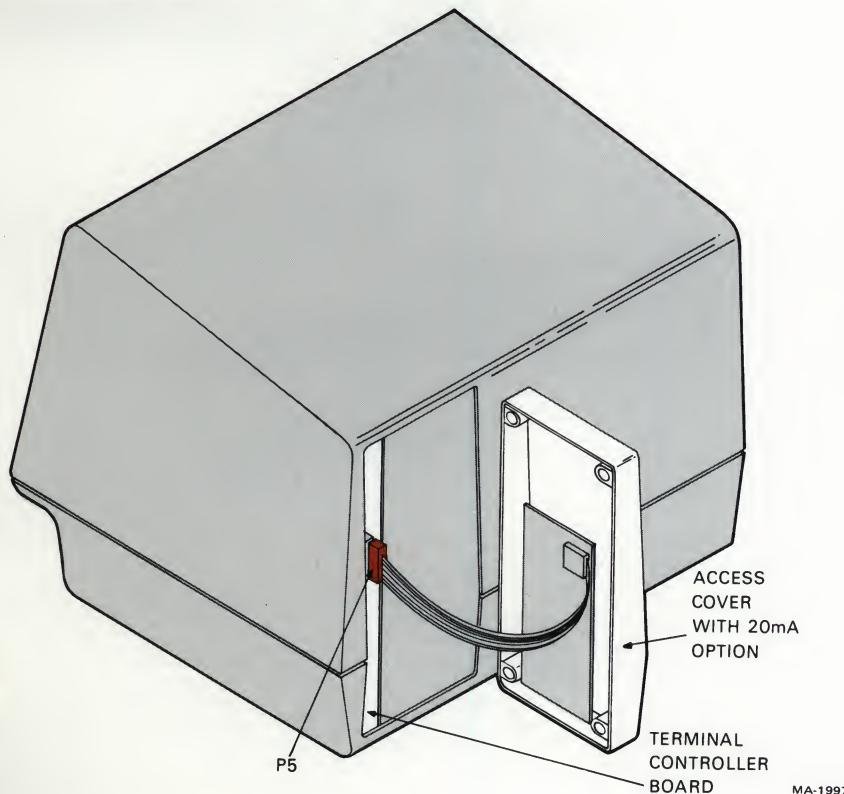


Figure 4-4
Terminal Controller Board

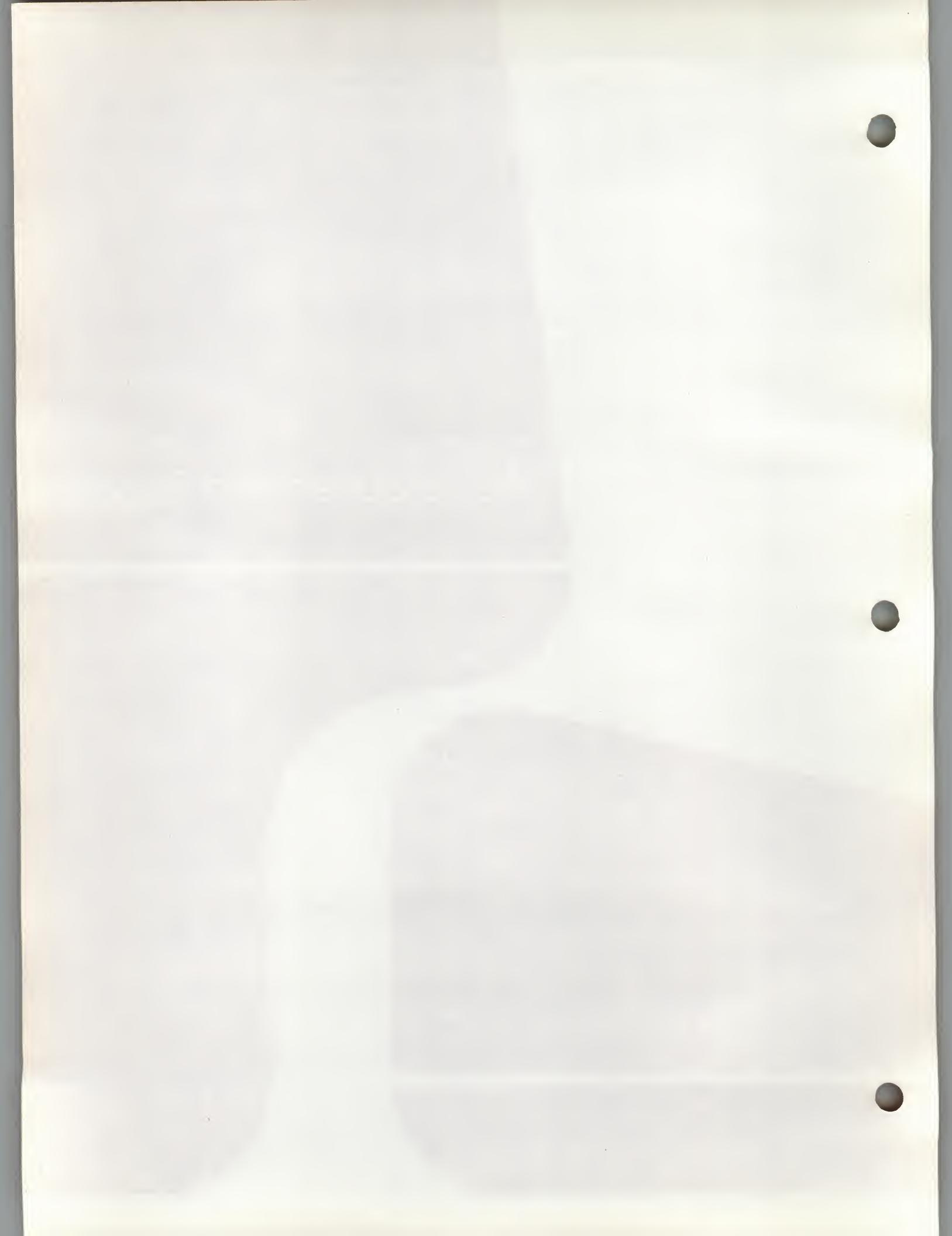
6. A loopback error is shown by "8" being displayed in the upper left corner of the screen. If an error is detected, check the 20 mA board connectors and switch settings and then repeat Step 5. If the error persists, contact your service organization.
7. Once the test is complete return the 20 mA current loop board switches to the original positions, remove the loopback connector, replace the access cover, and reconnect the terminal to the communications line.

COMMUNICATIONS CABLES

The communication cables available for use with the VT100 are listed in Chapter 5.



Accessories and Supplies

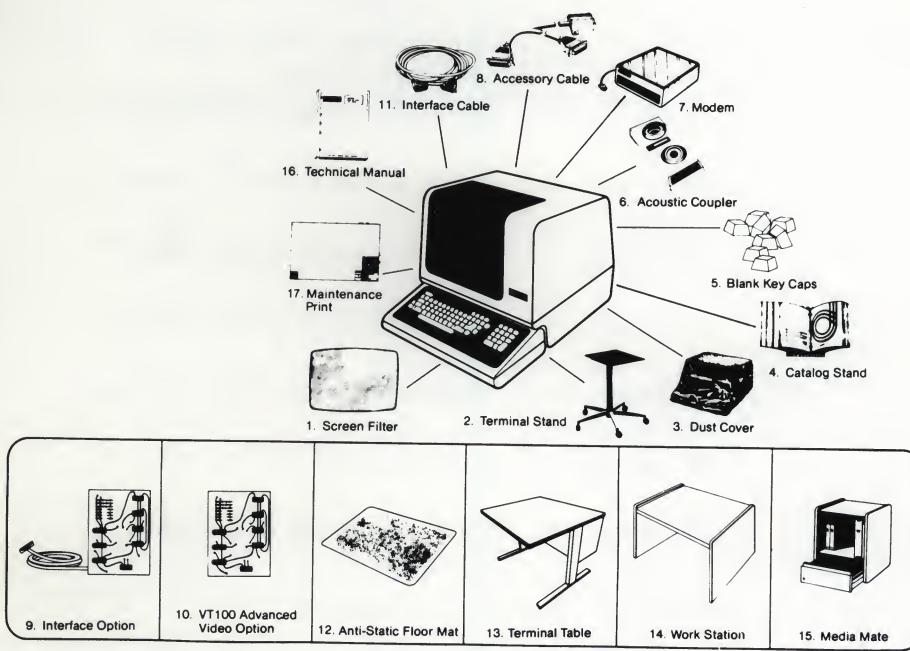


CHAPTER 5

ACCESSORIES AND SUPPLIES

GENERAL

The VT100 video terminal is a data transaction terminal supporting a wide variety of user-controllable character and screen attributes. Additional features include smooth scrolling, selectable column widths and typewriter-like detachable keyboard. The following describes VT100 supplies and accessories.



SUPPLIES

	DEC	
Item Number	Part Number	Description

ACCESSORIES

1	VT1 XX-AE	VT100 formed screen filter, gray anti-glare coating
1	VT1 XX-AR	VT100 nonreflective filter screen
2	VT1 XX-ST	VT100 terminal stand with casters
2	VT1 XX-SU	VT100 terminal table (VT1 XX-ST), lot of 25
2	VT1 XX-SV	VT100 terminal table (VT1 XX-ST), lot of 50
3	H9850-HK	Heavy gauge vinyl dust cover, charcoal brown
4	H980-CS	Catalog stand with eight one-inch removable cartridges for 8-1/2 inches X 11 inches documentation
4	H980-CP	Cartridges for catalog stand
5	LA12X-UA	Blank keycap kit of 50, Row 4*
5	LA12X-UB	Blank keycap kit of 50, Row 1*
5	LA12X-UB	Blank keycap kit of 50, Row 1*
5	LA12X-UC	Blank keycap kit of 50, Row 2*
5	LA12X-UD	Blank keycap kit of 50, F&J type
5	LA12X-UE	Blank keycap kit of 50, SET-UP
5	LA12X-UF	Blank keycap kit of 50, TAB
5	LA12X-UH	Blank keycap kit of 50, CAP LOCK
5	LA12X-UJ	Blank keycap kit of 50, SHIFT
5	LA12X-UL	Main array blank keycap set

* Row 1 is the row immediately above Space Bar

Item Number	DEC Part Number	Description
5	LA12X-UM	Blank keycap kit of 50, CR
5	LA12X-UN	Blank keycap kit of 50, ENTER
5	LA12X-UP	Blank keycap kit of 50, Num Pad 0
5	LA12X-UR	Blank keycap kit of 50, Row 3*
5	LA12X-US	Blank keycap kit of 50, Row 5*
5	LA12X-UT	Numeric pad blank keycap set
6	DF01-A	Acoustic telephone coupler, 300 bps with combination EIA (RS232-C) and 20 mA current loop cable
7	DF02-AA	Direct connect, Bell 103J equivalent, 300 bps full-duplex modem with EIA RS232-C interface
8	30-10958-02	Cable to interface older DF01 couplers to VT100
9	VT1XX-AA	VT100 20 mA current loop option with cable
9	VT1XX-AC	VT100 printer port
10	VT1XX-AB	VT100 advanced video option
11	BC03M-50	Female-female null modem cable, 50 ft (15.2 m)
11	BC03M-A0	Female-female null modem cable, 100 ft (30.5 m)
11	BC03M-B5	Female-female null modem cable, 250 ft (76.2 m)
11	BC03M-EO	Female-female null modem cable, 500 ft (152.4 m)

* Row 1 is the row immediately above Space Bar

Item Number	DEC Part Number	Description
11	BC05D-10†	RS-232 female to RS-232 male: EIA extension cable (14 conductor) used with VT100 for modem connections, 10 ft (3.0 m)
11	BC05D-25†	RS-232 female to RS-232 male: EIA extension cable (14 conductor) used with VT100 for modem connections, 25 ft (7.6 m)
11	BC05D-50†	RS-232 female to RS-232 male: EIA extension cable (14 conductor) used with VT100 for modem connections, 50 ft (15.2 m)
11	BC05F-15‡	MATE-N-LOK to MATE-N-LOK: 20 mA; direct connection between VT100 with a 20 mA option installed and a line unit, 15 ft (4.6 m)
11	BC05F-50‡	MATE-N-LOK to MATE-N-LOK: 20 mA; direct connection between VT100 with a 20 mA option installed and a line unit, 50 ft (15.2 m)
11	BC05F-AO‡	MATE-N-LOK to MATE-N-LOK: 20 mA; direct connection between VT100 with a 20 mA option installed and a line unit, 100 ft (30.5 m)
11	BC03M-LO	Female-female null modem cable, 1000 ft (304.8 m)
11	BC05X-15	20 mA current loop extension cable, 15 ft (4.6 m)
11	BC05X-25	20 mA current loop extension cable, 25 ft (7.6 m)
11	BC05X-50	20 mA current loop extension cable, 50 ft (15.2 m)

* Row 1 is the row immediately above Space Bar

† For use with a DFO1-A Acoustic Coupler. Pin 23 of this cable must be disconnected.

‡ A BC05F-15 cable is shipped with the VT1XX-AA option.

Item Number	DEC Part Number	Description
11	BC22A-10	EIA RS232 female-female null modem cable shielded 10 ft (3.0 m)
11	BC22A-25	EIA RS232 female-female null modem cable shielded 25 ft (7.6 m)
11	BC22B-10 §	EIA RS232 male-female extension cable shielded 10 ft (3.0 m)
11	BC22B-25 §	EIA RS232 male-female extension cable shielded 25 ft (7.6 m)
11	BC23A-10	Kit of 5 BC22A-10
11	BC23A-25	Kit of 5 BC22A-25
11	BC23B-10	Kit of 5 BC22B-10
11	BC23B-25	Kit of 5 BC22B-25
12	H9850-DA	Anti-static floor mat, DECmat, 4 ft X 6 ft (122 cm X 183 cm), Driftwood color (brownish/gray)
12	H9850-DB	Anti-static floor mat, DECmat, 4 ft X 6 ft (122 cm X 183 cm), Summer Earth color (brown/gold)
12	H9850-DC	Anti-static floor mat, DECmat, 3 ft X 10 ft (91 cm X 305 cm), Silver Birch color (silvergray/brown)
12	H9850-DD	Anti-static floor mat DECmat, 3 ft X 10 ft (91 cm X 305 cm), Autumn Bronze color (orange/brown)
12	H9850-DE	Anti-static floor mat, DECmat, 3 ft X 10 ft (91 cm X 305 cm), Driftwood color (brownish/gray)

* Row 1 is the row immediately above Space Bar

† For use with a DFO1-A Acoustic Coupler. Pin 23 of this cable must be disconnected.

‡ A BC05F-15 cable is shipped with the VT1XX-AA option.

§ This cable cannot be used with a DFO1-A Acoustic Coupler. Use cable BC05D-XX in its place.

Item Number	DEC Part Number	Description
12	H9850-DF	Anti-static floor mat, DECmat, 4 ft X 6 ft (122 cm X 183 cm), Silver Birch color (silvergray/brown)
12	H9850-DH	Anti-static floor mat, DECmat, 4 ft X 6 ft (122 cm X 183 cm), Autumn Bronze color (orange/brown)
13	H970-EB	Terminal table, 27 inches high X 36 inches wide X 30 inches deep (68.6 cm X 91.4 cm X 76.2 cm) with levelers
13	H970-HB	Terminal table, 27 inches high X 24 inches wide X 30 inches deep (68.6 cm X 61.0 cm X 76.2 cm) with levelers
14	H9532-AA	Work-station desk with blue front panel and gray side panels, levelers, 48 inches wide X 30 inches high X 30 inches deep (122 cm X 76.2 cm X 76.2 cm)
14	H9532-AB	Work-station desk with brown front panel and brown side panels, levelers, 48 inches wide X 30 inches high X 30 inches deep (122 cm X 76.2 cm X 76.2 cm)
14	H9614-AB	Split top add-on work station, one side panel
14	H9614-AD	Split top standalone unit
14	H9614-AF	Split top dual add-on unit (uses H9610 end panels for support)
15	H9850-AP	Media Mate™, file or shelf storage cart with casters and lockable drawer, 25.25 inches high X 15 inches deep X 18.5 inches wide (64.1 cm X 38.1 cm X 47.0 cm)
16	EK-18251-20	Terminals and Communications Handbook
16	EK-VT100-UG	VT100 User's Guide

Item Number	DEC Part Number	Description
16	EK-VT100-J1	VT100 Mini Maintenance Manual
16	EK-VT100-IP	VT100 Video Terminal IPB
16	EK-VT100-RC	VT100 Program Reference Card
16	EK-VT100-TM	VT100 Technical Manual
17	MP-00633	VT100 Maintenance Prints

SPARES KITS

-	4A-VT100	VT100 Spares Kit
-	4A-LOTVT-AA	Lot of 10, 30-16080-01, XFRMR, fly back (ELSTON)
-	4A-LOTVT-AB	Lot of 10, 30-16080-02, PC Board Assy (ELSTON)
-	4A-LOTVT-AC	Lot of 10, 54-13009, VT100 Basic Video
-	4A-LOTVT-AD	Lot of 10, 70-14979, Power Supply Assy
-	4A-LOTVT-AE	Lot of 10, 70-15765, Keybrd/Keycap Assy

HOW TO ORDER

Telephone Orders

Continental USA call	800-258-1710 (8:30 am to 6:00 pm EST)
In New Hampshire, call	603-884-6660 (8:30 am to 6:00 pm EST)
In Alaska, and Hawaii, call	408-734-4915 (8:15 am to 5:00 pm PST)

IMPORTANT INFORMATION CONCERNING TELEPHONE ORDERS

- Minimum order of \$100.00 unless charged to MasterCard or VISA.
- Maximum order of \$5,000.00
- Phone orders are accepted at current list price only.
- Phone orders are accepted per DIGITAL standard terms and.

DIRECT MAIL ORDERS

- Purchase orders should be mailed directly to:

US CUSTOMERS

DIGITAL EQUIPMENT CORPORATION
PO Box CS2008
Nashua, New Hampshire 03061

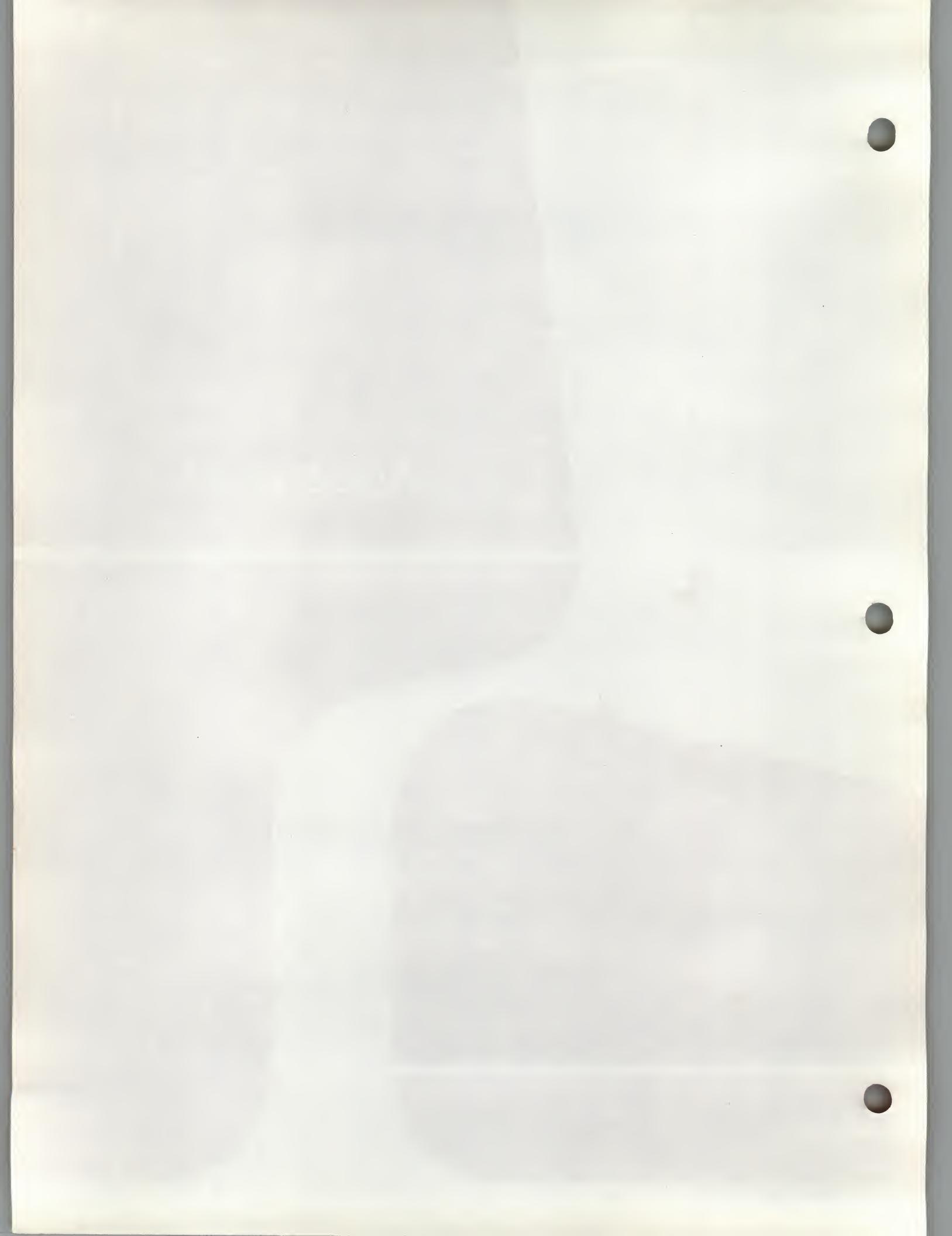
INTERNATIONAL CUSTOMERS

DIGITAL EQUIPMENT CORPORATION
A&SG Business Manager
c/o DIGITAL's local subsidiary

IMPORTANT INFORMATION CONCERNING DIRECT MAIL ORDERS

- Minimum order value of \$100.00 unless paid by check, money order, or credit card (MasterCard or VISA)
- No maximum order value
- Purchase orders may also be submitted to your local DIGITAL Sales Office.

Appendices



APPENDIX A

ANSI DEFINITIONS AND NOTATION

ANSI DEFINITIONS

Active position – The character position on the visual display that is to display the graphic symbol representing the next graphic character.

ANSI mode – A VT100 mode in which it recognizes and responds only to escape sequences whose syntax and semantics are in accordance with ANSI specifications.

Character position – That portion of a visual display which is displaying or is capable of displaying a graphic symbol.

Control – A control character, an escape sequence, or a control sequence that performs a control function.

Control character – A character whose occurrence in a particular context initiates, modifies, or stops a control function.

Control function – An action that affects the recording, processing, transmission, or interpretation of data.

Control sequence – A sequence of characters that is used for control purposes to perform a control function, that begins with the control sequence introducer (CSI) control, and that may contain a parameter string.

Control sequence introducer (CSI) – An escape sequence that provides supplementary controls and that is itself a prefix affecting the interpretation of a limited number of contiguous characters.

Control string – A string of characters that is used to perform a control function and that is delimited by an opening and closing delimiter control.

Cursor – A visual representation of the active position which is either a blinking reverse-video or blinking underline.

Cursor control – An editor function that moves the active position.

Default – A function-dependent value that is assumed when no explicit value, or a value of 0, is specified.

Display – The current active area of the screen, i.e., the area inside the scrolling region, or the entire screen, depending on the origin mode.

Editor function – A control that affects the layout or positioning of previously entered or received information in a printing or cathode ray tube device and that is intended to be interpreted and executed without remaining in the data stream. (See format effector.)

Escape character (ESC) – A control character that provides supplementary characters (code extension) and that is itself a prefix affecting the interpretation of a limited number of contiguous characters.

Escape sequence – A sequence of characters that is used for control purposes to perform a control function and whose first character is the escape (ESC) control character.

Final character – A character whose bit combination terminates an escape or control sequence designated by F.

Format effector – A control that affects the layout or positioning of information on the screen and that may remain in the data stream subsequent to interpretation and processing. (See editor function.)

Graphic character – A character, other than a control character, that has a visual representation normally handwritten, printed, or displayed.

Home – The character position at the origin. [See origin mode (DECOM).]

Intermediate character – A character whose bit combination precedes a final character in an escape or control sequence.

Numeric parameter – A string of bit combinations that represents a number, designated by Pn.

Parameter – (1) A string of one or more characters that represent a single value; (2) The value so represented.

Parameter string – A string of characters that represent one or more parameter values.

Selective parameter – A string of bit combinations that selects a subfunction from a specified list of subfunctions, designated by Ps. In general, a control sequence with more than one selective parameter causes the same effect as several control sequences, each with one selective parameter, e.g., CSI Psa; Psb; Psc F is identical to CSI Psa F CSI Psb F CSI Psc F.

VT52 mode – A VT100 mode in which it recognizes and responds only to escape sequences which DEC VT52 type terminals use.

NOTATION

I - An intermediate character in an escape sequence or a control sequence, where **I** is from 40_8 to 57_8 inclusive.

F - A Final character in:

1. An escape sequence, where **F** is from 60_8 to 176_8 inclusive.
2. A control sequence, where **F** is from 100_8 to 176_8 inclusive.

Pn - A numeric parameter in a control sequence, where **Pn** is a string of zero or more characters from 60_8 to 71_8 inclusive.

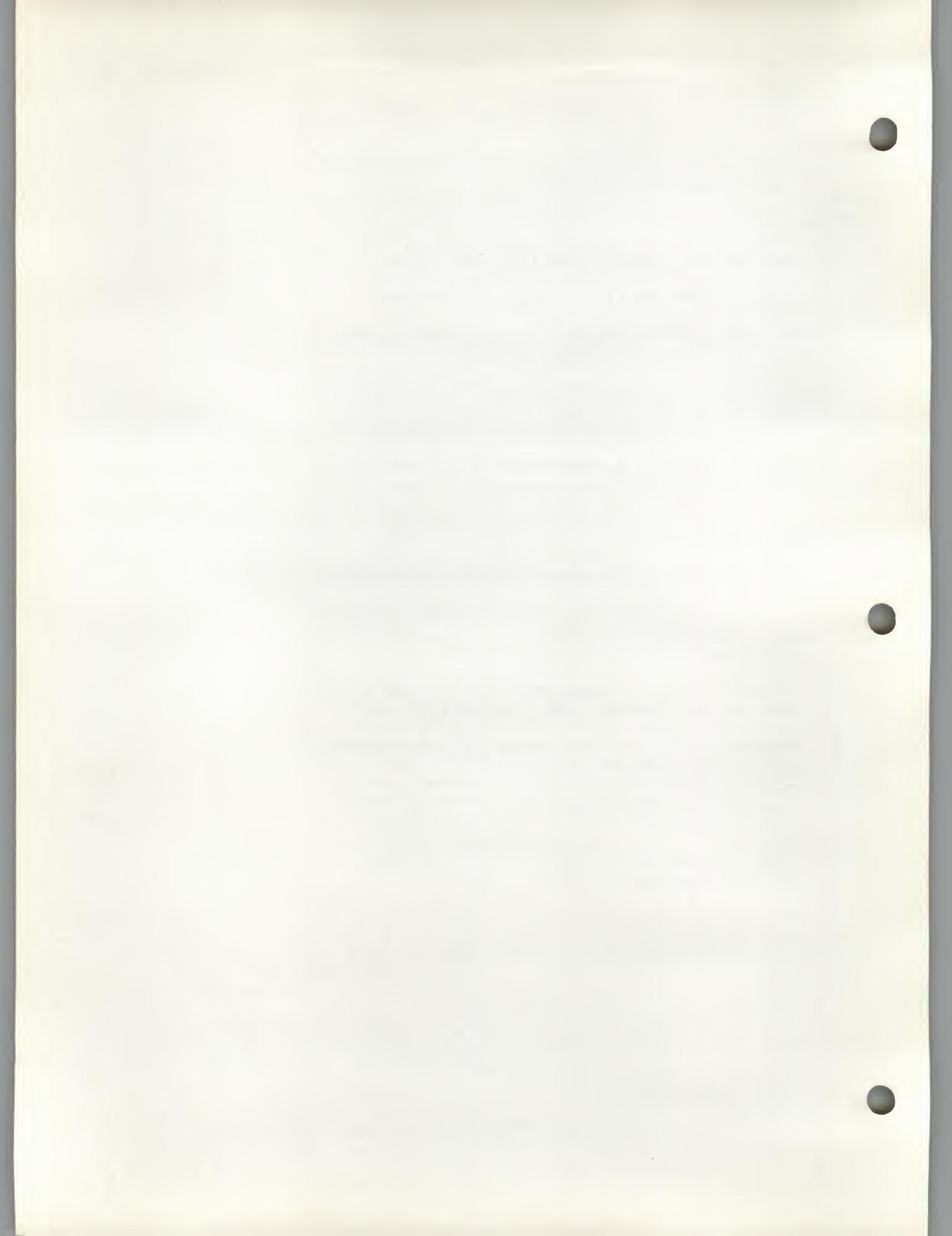
Ps - A variable number of selective parameters in a control sequence, with each selective parameter separated from the other by 73_8 . **Ps** is a string of zero or more characters from 60_8 to 71_8 inclusive and 73_8 .

Example: The format of an escape sequence as defined in American National Standard X 3.41-1974 and used in the VT100 is:

ESC I . . . I F

Where:

1. **ESC** is the introducer control character (33_8) that is named escape.
2. **I . . . I** are the intermediate bit combinations that may or may not be present. **I** characters are bit combination 40_8 to 57_8 inclusive in both 7- and 8-bit environments.
3. **F** is the final character. **F** characters are bit combinations 60_8 to 176_8 inclusive in escape sequences in both 7- and 8-bit environments.
4. The occurrence of characters in the inclusive ranges of 0_8 to 37_8 within an escape or control sequence, is technically an error condition whose recovery is to execute immediately the function specified by the character and then continue with the escape sequence execution. The exceptions are: If the character **ESC** occurs, the current escape sequence is aborted, and a new one commences, beginning with the **ESC** just received. If the character CAN (30_8) or the character SUB (32_8) occurs, the current escape sequence is aborted.



APPENDIX B

7-BIT ASCII CODE

Octal Code	Char	Octal Code	Char	Octal Code	Char	Octal Code	Char
000	NUL	040	SP	100	@	140	'
001	SOH	041	!	101	A	141	a
002	STX	042	"	102	B	142	b
003	ETX	043	#	103	C	143	c
004	EOT	044	\$	104	D	144	d
005	ENQ	045	%	105	E	145	e
006	ACK	046	&	106	F	146	f
007	BEL	047	,	107	G	147	g
010	BS	050	(	110	H	150	h
011	HT	051	)	111	I	151	i
012	LF	052	*	112	J	152	j
013	VT	053	+	113	K	153	k
014	FF	054	,	114	L	154	l
015	CR	055	-	115	M	155	m
016	SO	056	.	116	N	156	n
017	SI	057	/	117	O	157	o
020	DLE	060	0	120	P	160	p
021	DC1	061	1	121	Q	161	q
022	DC2	062	2	122	R	162	r
023	DC3	063	3	123	S	163	s
024	DC4	064	4	124	T	164	t
025	NAK	065	5	125	U	165	u
026	SYN	066	6	126	V	166	v
027	ETB	067	7	127	W	167	w
030	CAN	070	8	130	X	170	x
031	EM	071	9	131	Y	171	y
032	SUB	072	:	132	Z	172	z
033	ESC	073	;	133	[	173	{
034	FS	074	<	134	\	174	|
035	GS	075	=	135	]	175	|
036	RS	076	>	136	^	176	~
037	US	077	?	137	—	177	DEL

2000-2001

2001-2002

APPENDIX C

FILL CHARACTER REQUIREMENTS

Fill characters are required to keep the VT100 synchronized with the host computer when the XON/XOFF control codes are not used. Table C-1 shows the VT100 fill character requirements for every receive speed at which the terminal is capable of operating. No entry in a column indicates that fill characters are not required in that specific case.

Control Function		<i>NEL, IND, LF, RI (Smooth scroll feature selected)</i>		<i>ED</i>		<i>EL</i>		<i>DECINLM</i>		<i>All others except DECTST and RIS</i>	
		<i>DECALN</i>	<i>DEC COLM</i>			<i>DECALN</i>	<i>DEC COLM</i>			<i>DECINLM</i>	
Receive	19200	384	243	243	90	60	4	2	2		
Baud	9600	192	122	122	45	30	2	1	1		
Rate	4800	96	61	61	23	15	1	1	1		
	3600	72	46	17	11	1					
	2400	48	30	30	11	7					
	2000	40	25	25	9	6					
	1800	36	23	23	9	6					
	1200	24	15	15	6	4					
	600	12	8	8	3	2					
	300	6	4	4	1	1					
	200	4	3	3	1	1					
	150	3	2	2	1						
	134.5	3	2	2	1						
	110	2	1	1	1						
	75	2	1	1							
	50	1	1	1							

Table C-1
Fill Character Requirements

OTHER TERMINALS

The terminal is the link between the user and the power of the computer. Often the right terminal, or the right enhancement to the terminal can make your work easier, more efficient, or more cost effective. For that reason, DIGITAL offers a full range of video and teleprinter terminals and options that can help you tackle any application.

30 CHARACTER PER SECOND KEYBOARD PRINTER

LA34/LA38 DECwriter IV

Everything about the 300 baud desk-top terminals adds up to convenience. They are smaller, lighter and quieter than many typewriters. They have sculptured, typewriter-like keys and a cartridge for simple ribbon changes. All features are set at the keyboard, including four character width adjustments. They also have automatic self-test diagnostics.

180 CHARACTER PER SECOND KEYBOARD PRINTER

The LA120, DIGITAL's fastest hardcopy terminal, offers better throughput than that of terminals with faster print speeds. The 180 character per second printhead prints bidirectionally and always seeks the next print position. The LA120 offers an unexcelled range of standard features. Over 45 keyboard-selectable features are offered. These features include variable font sizes, tabs, form length and many other features previously available only as options. To guide the operator through the myriad of possible configurations, the carefully human-engineered terminal uses mnemonic commands, a prompting LED display, a special decal and a convenient pocket-sized operator card.

INTELLIGENT VIDEO TERMINAL

At the head of the VT100 class are DIGITAL'S intelligent PDT-11 terminals. The PDT family includes three programmable data terminals; the PDT-11/110, the PDT-11/130, and the PDT 11/150. With their PDP-11 compatible processors and RT-11 operating system, the PDTs permit you to draw on a wide range of existing software. Local mass storage is available on the PDT-11/130 in the form of 511K bytes of storage provided in dual mini-cartridges. Housed within the same VT100 shell, these mini-cartridges are file-structured system devices. The PDT-11/150 lets you combine the functionality of the PDT-11 with the dual floppy disk storage of any DIGITAL terminal. With its four ports, the PDT-11/150 allows considerable system expansion. Add a terminal controller if you want the flexibility of up to four terminals. For hardcopy, add a printer to the printer port. There is a third port for an EIA link to a host computer.

There's lots more to tell about these terminal products. If you would like more information on any of these products just fill out the postage paid card and drop it in a mailbox or write:

DIGITAL EQUIPMENT CORPORATION
Components Group
One Iron Way
Marlboro, MA 01752

ATTN: MARKETING MANAGER
MR2-2/M70

VT100 USER GUIDE

Your comments and suggestions will help us in our continuous effort to improve the quality and usefulness of our publications.

What is your general reaction to this manual? In your judgement is it complete, accurate, well organized, well written, etc? Is it easy to use? _____

What features are most useful? _____

What faults or errors have you found in the manual? _____

Does this manual satisfy the need you think it was intended to satisfy? _____

Does it satisfy *your* needs? _____ Why? _____

Please send me the current copy of the *Technical Documentation Catalog*, which contains information on the remainder of DIGITAL's technical documentation.

Name _____ Street _____
Title _____ City _____
Company _____ State/Country _____
Department _____ Zip _____

Additional copies of this document are available from:

Digital Equipment Corporation
Accessories and Supplies Group
P.O. Box CS2008
Nashua, New Hampshire 03061

Attention: Documentation Products
Telephone: 1-800-258-1710

Order No. _____ EK-VT100-UG-003

----- Fold Here -----

----- Do Not Tear – Fold Here and Staple -----

digital



No Postage
Necessary
if Mailed in the
United States

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO.33 MAYNARD, MA.

POSTAGE WILL BE PAID BY ADDRESSEE

Digital Equipment Corporation
Educational Services Development and Publishing
129 Parker Street, PK3-1/T12
Maynard, MA 01754

INSTALLATION, WARRANTY, AND SERVICE INFORMATION

INSTALLATION/WARRANTY

For customers who have purchased directly from DIGITAL, reference the sales agreement for installation and warranty terms purchased with this terminal.

For customers who have purchased, leased, or rented from a vendor other than DIGITAL, contact your vendor for information regarding installation and warranty terms purchased with this terminal.

DIGITAL SERVICES

A wide range of maintenance and customer services are available from DIGITAL for your terminal. Through use of these services, you can design a plan which meets your service needs, from complete DIGITAL maintenance to complete self-maintenance. Vendors supplying DIGITAL products may use these services as factory backup support.

- **On-Site Service**

DIGITAL offers responsive, low cost, factory-level maintenance performed at your site by trained Terminals Service Specialists through:

- Service Agreements which cover all your maintenance needs to include priority response; all labor, materials and travel for a fixed monthly charge.
- Per Call Service which is provided on a "time" and "materials" basis and can serve as a back-up to your own in-house maintenance programs.

- **Off-Site Service**

For those customers who have a significant level of troubleshooting expertise, but require Field Service assistance for the repair of components, DIGITAL has established a worldwide network of Product Repair Centers (PRCs) and the Customer Returns Area (CRA). Through a wide array of service product offerings this logistics network offers cost effective services to include:

- Module Mailer™
- Fixed Price Exchange
- Product Refurbishment

- **Spare Parts**

In an effort to further assist those customers who choose to perform their own computer maintenance, DIGITAL's Customer Spares organization is committed to providing thorough and timely spares support through:

- Spares Inventory Planning
- Component/Subassembly Spares
- Maintenance Test Equipment
- Maintenance Documentation Service
- Emergency Spare Parts

- **Training**

DIGITAL offers hardware maintenance courses through the Educational Services group at any of our 17 worldwide training centers; or depending on your specific training requirements, courses can be provided in your own facilities.

- **Terminal Supplies**

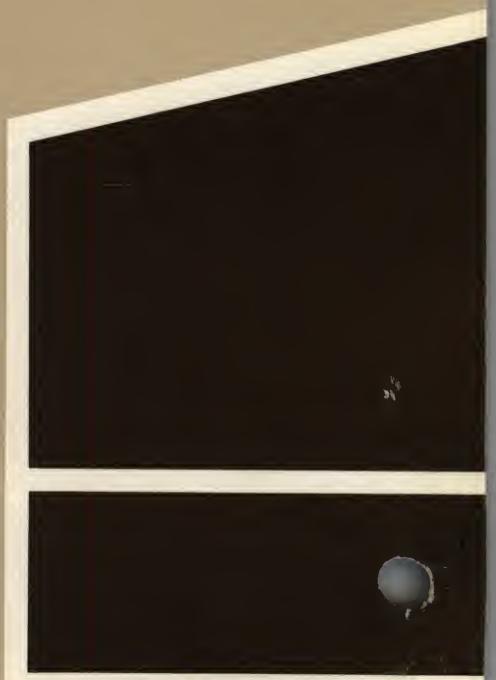
DIGITAL offers a variety of supplies to enhance terminal reliability and to make operation easier. Everything from furniture accessories, (cabinets, tables, etc.) to terminal supplies, such as paper, ribbons, diskettes, cassettes, labels, and many other items, as illustrated in the Supplies Brochures, are available through DIGITAL and may be obtained by dialing the toll-free number below. All orders may be placed via the toll-free number (800-258-1710) and will be processed within 24 hours (U.S. only – with the exception of Hawaii and Alaska).

To obtain further information concerning any of the customer services available, fill out the attached card or write:

DIGITAL EQUIPMENT CORPORATION
129 Parker Street
Maynard, MA 01754

ATTN: Customer Services Marketing – PK3-2/S25

digital



digital

VT101

VIDEO TERMINAL
USER GUIDE



digital

VT101

VIDEO TERMINAL
USER GUIDE

1st Edition, March 1981
2nd Edition, April 1981
3rd Edition, February 1982

Copyright © 1981, 1982 by Digital Equipment Corporation
All Rights Reserved

The reproduction of this material, in part or whole, is strictly prohibited. For copy information, contact the Educational Services Department, Digital Equipment Corporation, Maynard, Massachusetts 01754.

The information in this document is subject to change without notice. Digital Equipment Corporation assumes no responsibility for any errors that may appear in this document.

FCC Notice

This equipment generates and uses radio frequency energy. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against radio and television interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, the user is encouraged to try to correct the interference.

VDE Notice

RFI-suppressed according to German regulation 529/1970 and 227/1976 (VDE 0871 Class B).

Printed in U.S.A.

Mate-N-Lok™ is a trademark of Amp, Inc.

The following are trademarks of Digital Equipment Corporation, Maynard, Massachusetts.

DEC	DECnet	IAS
DECUS	DECsystem-10	MASSBUS
DIGITAL	DECSYSTEM-20	PDT
Digital Logo	DECwriter	RSTS
PDP	DIBOL	RSX
UNIBUS	EduSystem	VMS
VAX	OMNIBUS	VT
OS/8		

CONTENTS

CHAPTER 1 OPERATING INFORMATION

General	1
Terminal Operation	1
Controls and Indicators	3
Monitor Controls	3
Voltage Selection Switch	4
Power Switch	4
Internal Communication Switches	4
Keyboard Controls	4
Standard Keys	6
Function Keys	7
Keyboard Indicators	12
Audible Indicators	13
Keyclick	13
Bell Tone	13
Series of Bell Tones	13

CHAPTER 2 SET-UP FEATURES

General	15
SET-UP	15
Selecting Features	16
Feature Memories	17
Operating Memory	18
User Memory	18
Store	18
Recall	19
Reset	20
Default Memory	20
General Default	20
Tab Default	22
Feature Types	22
Operator Preference Features	22
Communication Compatibility Features	22
Installation Features	22

Feature Descriptions	23
General SET-UP Features	23
On/Off Line	24
Screen Brightness	24
SET-UP A Features	26
Columns Per Line	26
Tab Stops	26
SET-UP B Features	28
Scroll	30
Auto Repeat	31
Screen Background	31
Cursor	31
Margin Bell	32
Keyclick	32
ANSI/VT52	32
Auto XON/XOFF	32
US/UK Character Set	33
Auto Wrap	33
Linefeed/New Line	33
Interlace	33
Receive Parity	33
Reserved	34
Local Echo	34
Power	34
Data/Parity Bits	34
Transmit Speed	36
Receive Speed	37
Answerback	38

CHAPTER 3 TRANSMITTED CHARACTERS

General	41
Standard Keys	41
Function Keys	42
Control Character Keys	43
Numeric Keypad Keys	45

CHAPTER 4 RECEIVED CHARACTER PROCESSING

General	47
Received Characters	47
Display Characters	49
Control Characters	49
Escape and Control Sequences	50
Error Recovery	51
ANSI Compatible Sequences	54

SET-UP Feature and Mode Selection	54
ANSI/VT52 Compatibility	58
Scrolling	59
Scrolling Region	59
Origin	60
Cursor Positioning	61
Columns Per Line	64
Auto Wrap	65
Screen Background	66
Interlace	66
Linefeed/New Line	67
Auto Repeat	68
Cursor Key Character Selection	68
Keypad Character Selection	69
Character Sets and Selection	71
Character Attributes	76
Tab Stops	77
Line Attributes	78
Erasing	79
Reports	80
Reset	82
Tests	82
Adjustments	84
Keyboard Indicators	84
VT52 Compatible Sequences	85
Modes	85
ANSI/VT52 Compatibility	86
Cursor Positioning	86
Keypad Character Selection	88
Character Sets and Selection	90
Erasing	92
Reports	92

CHAPTER 5 COMMUNICATION

General	93
Connecting to the Computer	93
Serial Characters	95
Break	96
Full-Duplex Communication	96
Connection	98
Disconnection	98
Input Buffer Overflow Prevention	98
XON/XOFF Characters	98
Fill Characters	99
Low Speed Operation	100
Keyboard Transmit Buffer	101

CHAPTER 6 INSTALLATION

General	103
Site Considerations	103
Unpacking and Inspection Procedure	105
Packing Procedure	106
Installation Procedure	107
Communication Cables	109
Power-Up and Checkout Procedure	111

CHAPTER 7 OPTIONS

General	113
20 mA Current Loop Interface Option	113
Installation	114
Option Checkout	117

CHAPTER 8 MAINTENANCE AND TROUBLESHOOTING

General	121
Maintenance	121
Troubleshooting	121
Self-Tests	123
Power-Up Self-Test	124
Data Loopback Self-Test	125

CHAPTER 9 ACCESSORIES AND SUPPLIES

General	127
Accessories	128
Related DIGITAL Documentation	132
Alignment Templates	133
Data Loopback Test Connectors	133
Spares Kit	133
Ordering Information	134

APPENDIX A SPECIFICATIONS

APPENDIX B SET-UP SUMMARY

APPENDIX C PROGRAMMING SUMMARY

APPENDIX D CONTROL FUNCTIONS

APPENDIX E VT101/VT100 DIFFERENCES

INDEX

FIGURES

1-1	On-Line General Block Diagram	1
1-2	Off-Line General Block Diagram	2
1-3	Monitor Controls	3
1-4	VT101 Terminal Keyboard	5
1-5	Standard Keys	6
1-6	Function Keys	7
1-7	SET-UP Keys	9
1-8	Keyboard Indicators	12
2-1a	SET-UP A Display	15
2-1b	SET-UP B Display	16
2-2	SET-UP Feature Memories	17
2-3	SET-UP B Default Feature Selections	21
2-4	ON/OFF Line General Block Diagram	25
2-5	SET-UP A Display	27
2-6	80- and 132-Column Displays	27
2-7	SET-UP B Display	29
2-8	SET-UP B Summary	29
2-9	Screen Background	31
2-10	Local Echo	34
2-11	Answerback Message Summary	38
3-1	Standard Key Codes	41
3-2	Function Keys	42
3-3	Function Key Control Codes	43
5-1	Connecting to the Computer	93
5-2	Serial Character Format	94
5-3	EIA Connector and Pin Locations	95
6-1	VT101 Terminal Dimensions	104
6-2	Terminal Packing	105
6-3	Monitor Controls and Connector Locations	106
6-4	Cable Summary	110
7-1	20 mA Connector and Pin Locations	113
7-2	Access Cover Screw Locations	114
7-3	Access Cover Removal	115
7-4	20 mA Board Installation	115
7-5	20 mA Board Configuration	116
7-6	20 mA Loopback Connector	118
8-1	Monitor Controls	125
8-2	EIA Loopback Connector	126
9-1	Accessories and Supplies	127
A-1	Composite Video Output	138
B-1a	SET-UP A Screen Display	141
B-1b	SET-UP B Screen Display	142
B-2	SET-UP B Summary	142
C-1	Standard Key Codes	143
C-2	Function Key Control Codes	143

TABLES

2-1	SET-UP Feature Types	23
2-2	Data/Parity Bits Selections	35
2-3	Transmit Speed and Number of Stop Selections	36
2-4	Receive Speed and Number of Stop Selections	37
3-1	Cursor Control Key Code	43
3-2	Control Codes Generated	44
3-3	VT101 and Previous DIGITAL Terminal Key Differences	45
3-4	Numeric Keypad Codes	45
4-1	ASCII Table	48
4-2	Control Characters Recognized by VT101	49
4-3	Escape and Control Sequence Arrangement	52
4-4	SET-UP Features and Modes	55
4-5	ANSI Specified Modes	56
4-6	ANSI Compatible Private Modes	56
4-7	Permanently Selected Modes	57
4-8	Linefeed/New Line Feature	67
4-9	ANSI Cursor Control Key Codes	69
4-10	ANSI Numeric Keypad Codes	70
4-11	United Kingdom Character Set	72
4-12	United States Character Set	73
4-13	Special Characters and Line Drawing Character Set	74
4-14	VT52 Numeric Keypad Codes	89
4-15	Special Characters and Line Drawing Set and Graphics Mode Comparison	91
5-1	Possible Bell Modem Configurations	95
5-2	EIA Connector Signals	96
5-3	VT100/VT101 Fill Characters	100
6-1	Interface Cables	109
8-1	Problem Checklist	122

INTRODUCTION

PRODUCT INTRODUCTION

The VT101 video terminal is both an input and an output device of a computer. It uses a keyboard and display to communicate with a computer. As an input device, keyboard entries are transmitted to the computer. As an output device, characters received are displayed on the screen.

HOW TO USE THIS BOOK

This book describes general operating information, interface information, control function descriptions, and specific installation and checkout procedures. The main audiences for this book are the operator, applications programmer, and terminal installer. However, the operator should use this book only as a reference when operating the terminal. The document that describes how to use the application software is the primary document for the operator. The application software (program) determines how the computer and terminal operate.

The information in this book is divided by function. This allows you to reference a specific chapter according to the function to be performed. Also, the chapters are arranged by frequency of use. For example, operating information is frequently used, therefore it is at the beginning of the book. Installation is usually performed only once, therefore it is toward the end.

This book is divided into the following chapters.

Chapter 1 gives a general description of controls and indicators. This chapter also describes general operating procedures. Detailed operating information depends on the computer and its software.

Chapter 2 describes each SET-UP feature in detail. This chapter also provides the procedure for selecting each feature. Many SET-UP features change the way the terminal communicates with the computer. Detailed information on communication and related SET-UP features is in Chapter 5.

Chapter 3 shows the keys used to generate characters transmitted by the terminal.

Chapter 4 describes how the terminal processes received characters. This chapter also describes the use of control functions. Control functions are used to control the display, processing, transmission, and representation of characters by the terminal. This chapter is used by the application programmer when creating software used with this terminal.

Chapter 5 describes how the terminal communicates with the computer. Descriptions of communication features are also included.

Chapter 6 describes the environmental conditions to be considered before installing the terminal. This chapter gives detailed unpacking and installation procedures and step-by-step procedures to turn on (power-up) and checkout (verify correct operation) the terminal.

Chapter 7 describes the 20 mA current loop interface option and gives installation and checkout instructions.

Chapter 8 describes all maintenance and troubleshooting procedures used before requesting service. The troubleshooting information describes the terminal's self-tests.

Chapter 9 lists each accessory and supply, including the part number and ordering information.

Appendix A provides the VT101 terminal specifications.

Appendix B is a summary of the SET-UP feature displays.

Appendix C is a summary of VT101 terminal programming control functions.

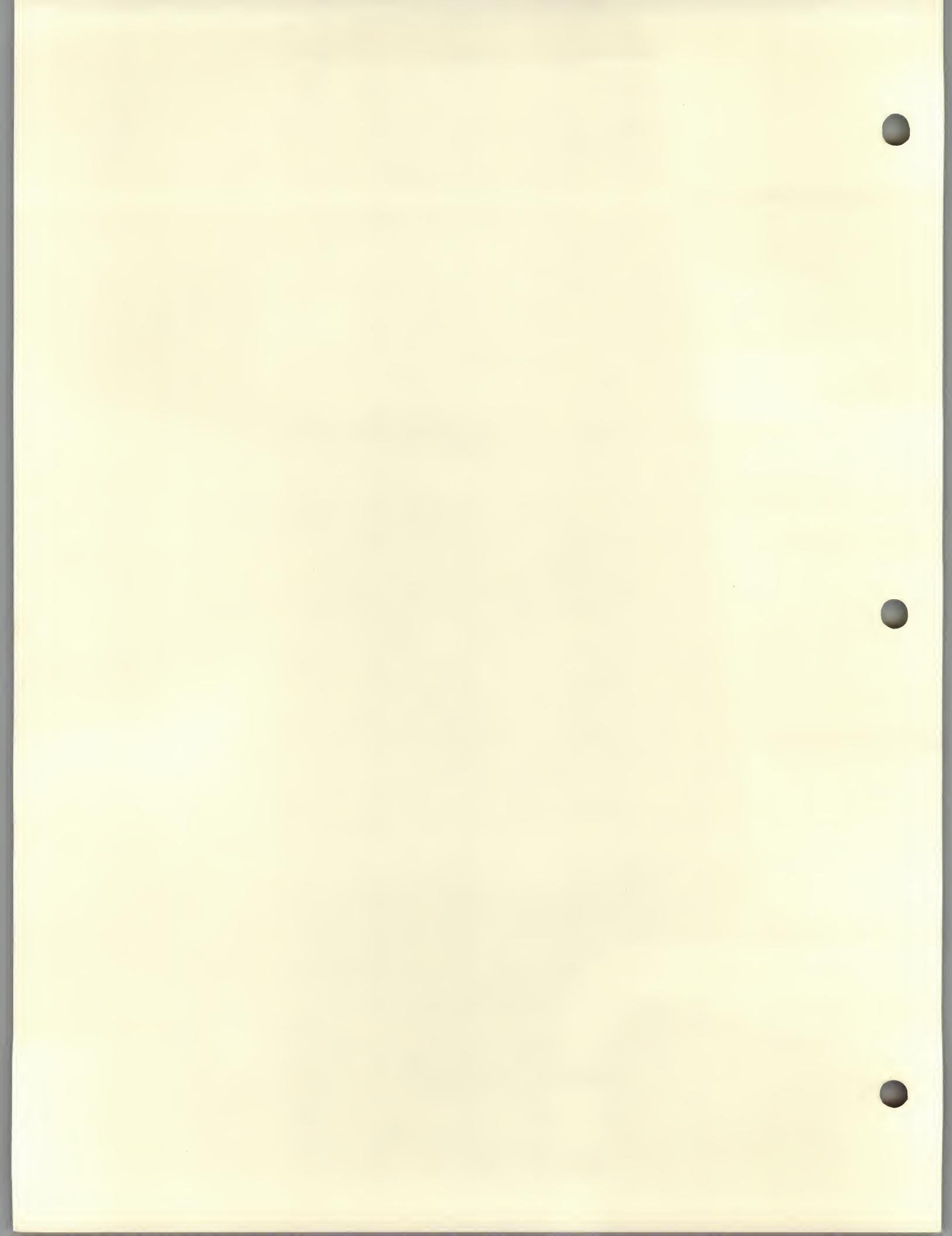
Appendix D describes the ANSI code extension techniques used to create escape and control sequences.

Appendix E describes the differences between the VT101 and VT100 terminals.

Warnings, Cautions, and Notes

In this book warnings, cautions, and notes have specific meanings. Warnings indicate information to prevent personal injury. Cautions indicate information to prevent damage to the terminal. Notes indicate general information.

Operating Information



OPERATING INFORMATION

GENERAL

This chapter provides a general overview of how the terminal operates. It also describes all controls, indicators, and general operating procedures. Detailed operating information depends on the computer and its application software.

TERMINAL OPERATION

The terminal operates either on-line, off-line, or in SET-UP. On-line and off-line are selected in SET-UP. Chapter 2 describes SET-UP and provides information about selecting on-line and off-line.

When the ON LINE keyboard indicator is on, the terminal is on-line. This means that the terminal can communicate with the computer. When on-line, the terminal is both an input and output device of the computer. Figure 1-1 is a general block diagram of the terminal while on-line.

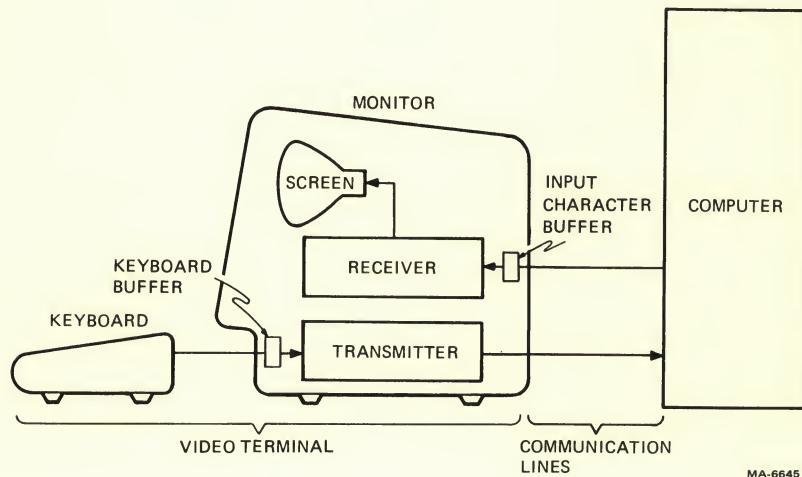


Figure 1-1 On-Line General Block Diagram

As an input device, all keyboard entries generate characters that are placed in a keyboard character buffer. The characters are then taken from the buffer and transmitted.

At the same time, the terminal is also an output device. Characters received by the terminal are placed in an input character buffer until processed. When processed, the received characters are taken from the buffer and displayed.

When the OFF LINE indicator is on, the terminal is off-line. This means that the terminal can not communicate with the computer. The terminal is considered disconnected from the computer. Characters typed on the keyboard are displayed on the screen. Figure 1-2 is a general block diagram of the terminal while off-line.

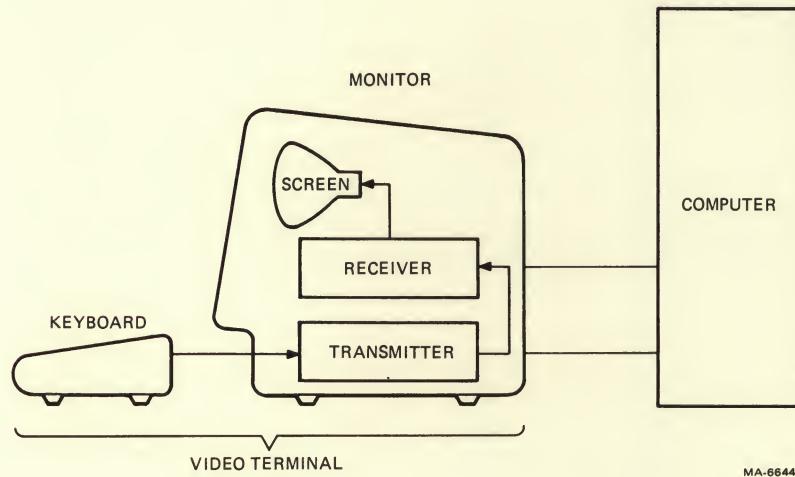


Figure 1-2 Off-Line General Block Diagram

CONTROLS AND INDICATORS

The terminal has many different controls and indicators. They are divided into five groups.

1. Monitor controls
2. Internal communication switches
3. Keyboard controls
4. Keyboard indicators
5. Audible indicators

Monitor Controls

The terminal has two controls on the monitor backpanel. The controls are the voltage selection switch and the power switch (Figure 1-3). The following paragraphs describe the monitor controls.

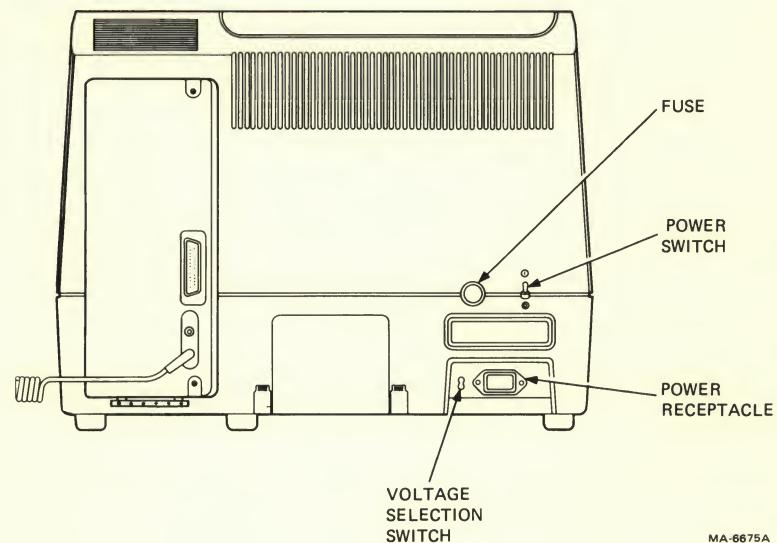


Figure 1-3 Monitor Controls

Voltage Selection Switch – This switch allows the terminal to operate with the available ac input voltage range. When the switch position is changed, the fuse must also be changed. The voltage selection switch and fuse are selected when the terminal is installed. Refer to Chapter 6 for more information about installing the terminal.

CAUTION: *Failure to set the voltage selection switch to the correct position and use the correct fuse may damage the terminal.*

Power Switch – This switch controls ac power to the terminal. When ac power is on, either the ON LINE or OFF LINE keyboard indicator is on. Refer to the Keyboard Indicators section in this chapter for more information about keyboard indicators.

Use the following procedure to turn the terminal on (power-up).

1. Turn the power switch to the on position (Figure 1-3). The terminal automatically runs a power-up self-test to verify the terminal is operating correctly. The test provides the following indications.
 - a. All keyboard indicators turn on and off, and either the ON LINE or OFF LINE indicator turns on.
 - b. A bell tone sounds.
 - c. The cursor displays in the upper-left corner of the screen.

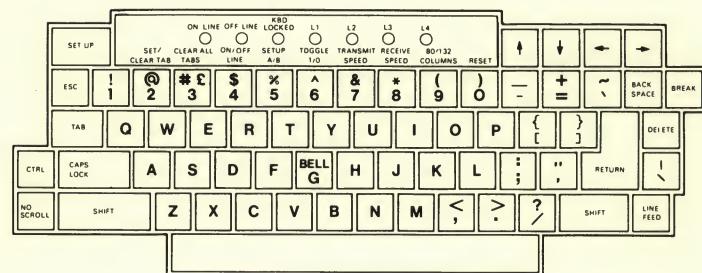
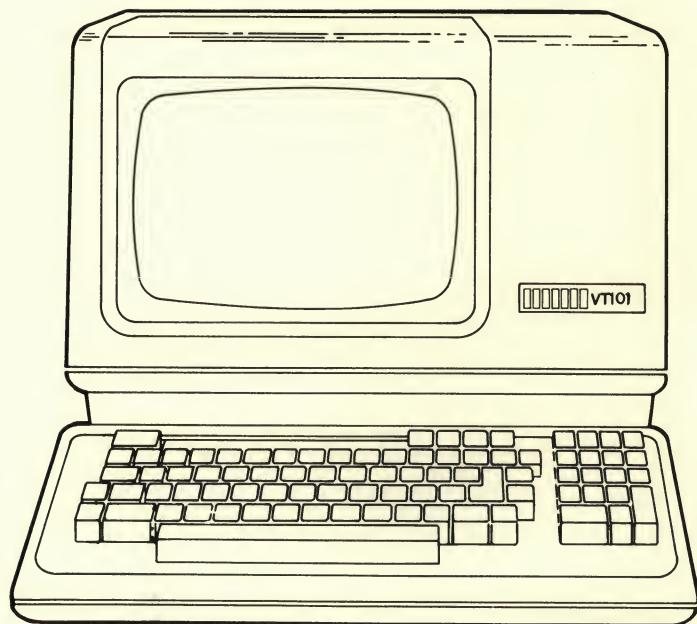
When the power-up self-tests finds an error: the terminal does not perform the above sequence, character(s) display on the screen, or several bell tones sound. Refer to Chapter 8 if the terminal does not power-up correctly.

Internal Communication Switches

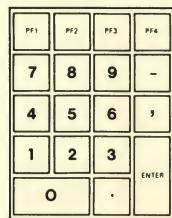
When the 20 mA current loop option (VT1XX-CA) is installed, the terminal has two internal switches. These switches determine if the 20 mA option is active or normal (passive) during operation. Refer to Chapter 7 for more information about the 20 mA option.

Keyboard Controls

The terminal has a main keyboard and numeric keypad (Figure 1-4). The main keyboard is arranged and operates like a standard typewriter. The numeric keypad is arranged for rapid entry of numeric data or function characters (used with some applications software). The keys are divided into three groups: standard keys, function keys, and SET-UP keys.



MAIN KEYBOARD



AUXILIARY KEYPAD

MA-7813

Figure 1-4 VT101 Terminal Keyboard



Figure 1-5 Standard Keys

Standard Keys – Figure 1-5 identifies the keys that are labeled as standard typewriter and calculator keys. The computer selects the numeric keypad to generate the same characters as the main keyboard. The minus, comma, period, and numeric keys on the keypad correspond to the unshifted keys on the main keyboard.

SHIFT and **CAPS LOCK** modify the standard key characters generated by the main keyboard. They do not modify the characters generated by the numeric keypad. **SHIFT** and **CAPS LOCK** are described in the following paragraphs. All character codes generated by the standard keys are given in Chapter 3.

SHIFT

SHIFT

When this key is pressed, the standard keys on the main keyboard generate uppercase characters. **SHIFT** does not affect the function keys.

CAPS LOCK

CAPS LOCK

This key is a two-position locking key. If it is locked in the down position, the alphabetic keys generate uppercase characters. If in the up position, the alphabetic keys generate lowercase characters. Numeric and special symbol keys are not affected by **CAPS LOCK**. **CAPS LOCK** does not affect the function keys or numeric keypad keys.

*NOTE: The numeric and special symbol keys are not affected by **CAPS LOCK**. Therefore, **CAPS LOCK** does not function like the **SHIFT LOCK** of a typewriter.*

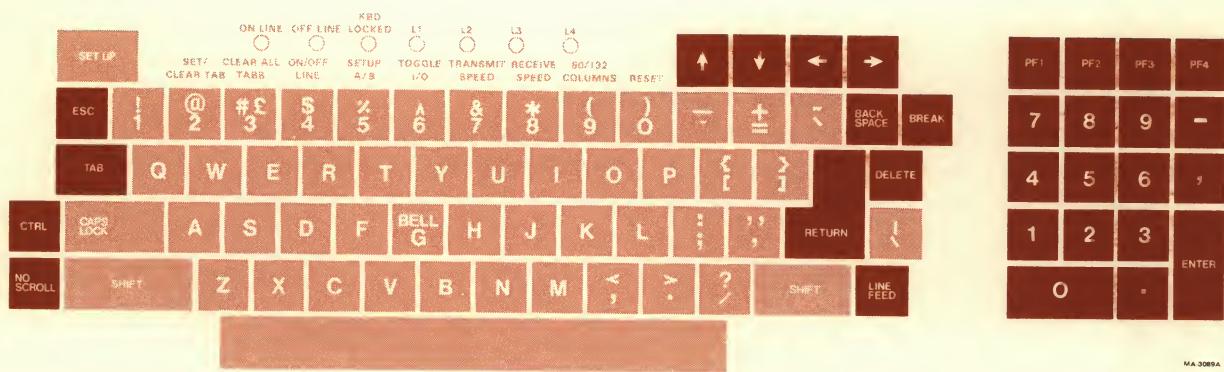


Figure 1-6 Function Keys

Function Keys – Figure 1-6 identifies the function keys. The computer can also select the numeric keypad to generate function characters. The use of the function characters is defined by the application software or communication system. All the characters generated by the function keys are given in Chapter 3. However, the following paragraphs provide a general description of each function key.

NO SCROLL

NO SCROLL

This key controls scrolling on the screen. Scrolling is the upward or downward movement of existing lines on the screen to allow new lines to be displayed. When this key is first pressed, new characters cannot be displayed and scrolling stops. When pressed again, new characters can be displayed and scrolling continues. **NO SCROLL** operates only when the auto XON/XOFF SET-UP feature is on. If the feature is off, this key does not function.

BREAK

BREAK

This key generates a break. Refer to Chapter 5 for more information about break.

When **SHIFT** is down, **BREAK** generates a long break disconnect. With some modems, a long break disconnect causes a communication (phone) line disconnect. Refer to Chapter 5 for more information about long break disconnects.

When **CTRL** is down, **BREAK** transmits the answerback message. The answerback message is used to identify the terminal to the computer. The answerback message is entered in SET-UP. Refer to Chapter 2 for more information about the answerback SET-UP feature.

**Cursor Control Keys**

The use of these keys is determined by the application software. However, these keys usually generate cursor control commands. The cursor is an indicator on the screen showing the line and column where the next character is displayed.

**ESCAPE**

This key generates the escape (ESC) control character. The use of the escape character is determined by the application software.

**TAB**

This key generates the tab (TAB) control character. The use of the tab character is determined by the application software.

**CONTROL**

While this key is down, pressing another key may generate a control character. The use of each character is determined by the application software. The control characters generated are given in Chapter 3.

**BACK SPACE**

This key generates the back space (BS) control character. The use of the back space character is determined by the application software.

**DELETE**

This key generates the delete (DEL) control character. The use of the delete control character is determined by the application program.

**RETURN**

This key generates either a carriage return, or carriage return (CR) and linefeed (LF). The characters generated are determined by the linefeed/new line feature. Refer to Chapter 2 for more information about the linefeed/new line SET-UP feature.

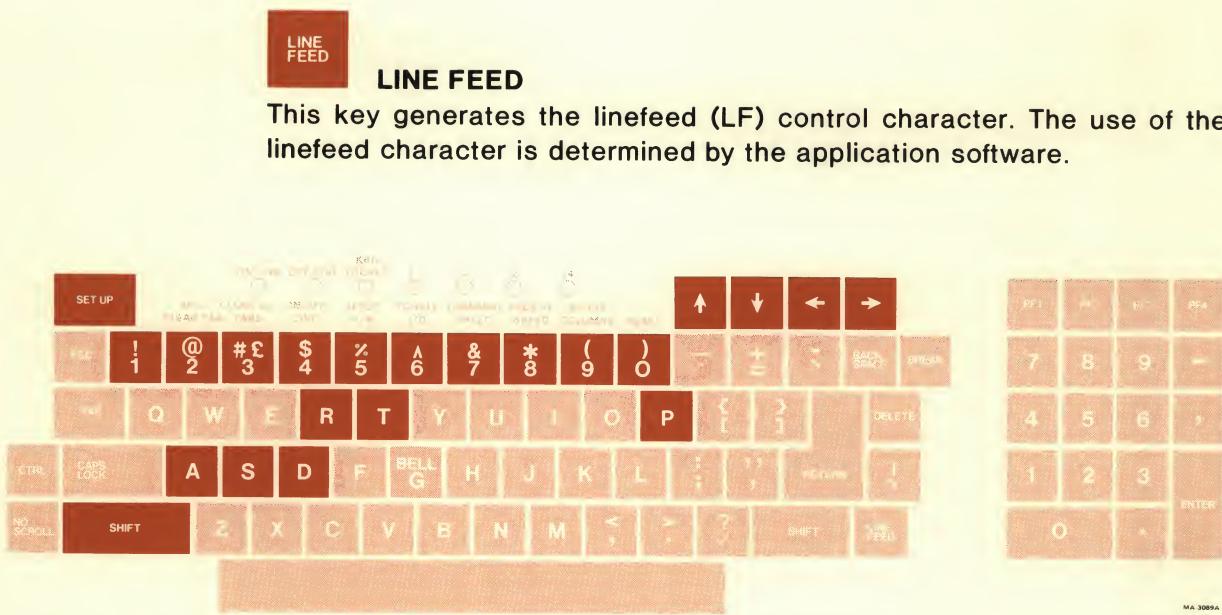


Figure 1-7 SET-UP Keys

SET-UP Keys – Figure 1-7 identifies the keys used while operating in SET-UP. SET-UP is used to select features of the terminal from the keyboard. SET-UP is divided into SET-UP A and SET-UP B display. Both displays show a summary of the feature selections. Chapter 2 provides both SET-UP feature descriptions and step-by-step feature selection procedures. Read Chapter 2 before using the SET-UP keys. The following paragraphs describe the keys used in SET-UP.



SET-UP

This key places the terminal in SET-UP. In SET-UP the terminal SET-UP features can be changed.



SET/CLEAR TAB

In SET-UP A, this key sets or clears *individual* horizontal tab stops in the terminal. This key does not function in SET-UP B.



CLEAR ALL TABS

In SET-UP A, this key clears *all* horizontal tab stops set in the terminal. This key does not function in SET-UP B.

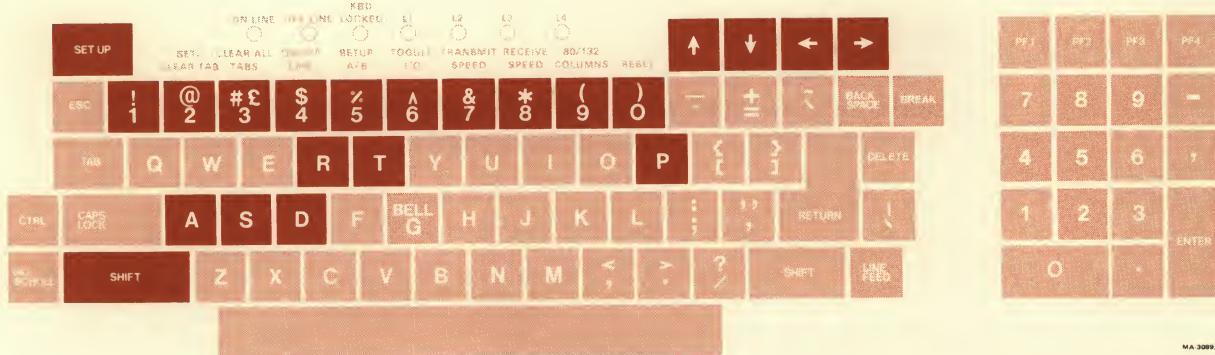


Figure 1-7 SET-UP Keys (Cont)

\$
4

ON/OFF LINE

In any SET-UP display, this key switches the terminal between on-line and off-line. While on-line, the terminal can communicate with the computer. While off-line, the terminal cannot communicate with the computer and keyboard entries are displayed on the screen.

%
5

SETUP A/B

In any SET-UP display, this key switches the terminal between SET-UP A and SET-UP B.

^
6

TOGGLE 1/0

In SET-UP B, this key changes the feature selected by the cursor. This key does not function in SET-UP A.

&
7

TRANSMIT SPEED

In SET-UP B, this key selects the transmit speed (baud rate) used by the terminal. This key does not function in SET-UP A.

8

RECEIVE SPEED

In SET-UP B, this key selects the receive speed (baud rate) used by the terminal. This key does not function in SET-UP A.

(
9

80/132 COLUMNS

In SET-UP A, this key selects the display line size. The size is either 80 or 132 columns per line. This key does not function in SET-UP B.



RESET

In any SET-UP display, this key starts the reset sequence. This sequence has the same result as turning the power switch off and then on.



Screen Brightness

In any SET-UP display, ↑ (up arrow) increases and ↓ (down arrow) decreases the brightness of the display.



Cursor Control Keys

In any SET-UP display, ← (left arrow) and → (right arrow) move the cursor left and right.



Answerback

In SET-UP B, the **SHIFT** and **A** keys allow the answerback message to be created. When **SHIFT** is down, press **A** to allow the answerback message to be created. The characters typed after the **SHIFT** and **A** keys are used as the answerback message. The answerback message is an identifying message stored in the terminal for transmission to the computer. When entering the answerback message into the terminal, all keyboard keys can be used.



Default

In any SET-UP display, the **SHIFT** and **D** keys select the default SET-UP feature selections. When **SHIFT** is down, press **D** to select the default SET-UP feature selections. A default feature selection is provided for each SET-UP feature. The actual default feature selections are listed in Chapter 2.



Data/Parity Bits

In SET-UP B, the **SHIFT** and **P** keys select the data/parity bits feature selection. When **SHIFT** is down, press **P** to change the number data bits per character and type of parity selected.



Recall

In any SET-UP display, the **SHIFT** and **R** keys perform a SET-UP feature recall. When **SHIFT** is down, press **R** to recall the SET-UP features stored in user memory.

S**Store**

In any SET-UP display, the **SHIFT** and **S** keys perform a SET-UP feature store. When **SHIFT** is down, press **S** to store the SET-UP features in operating memory into user memory.

T**Tab Default**

In SET-UP A, the **SHIFT** and **T** keys select a tab default. When **SHIFT** is down, press **T** to select a tab default. All tab stops are cleared and a tab stop is set every eighth character position.

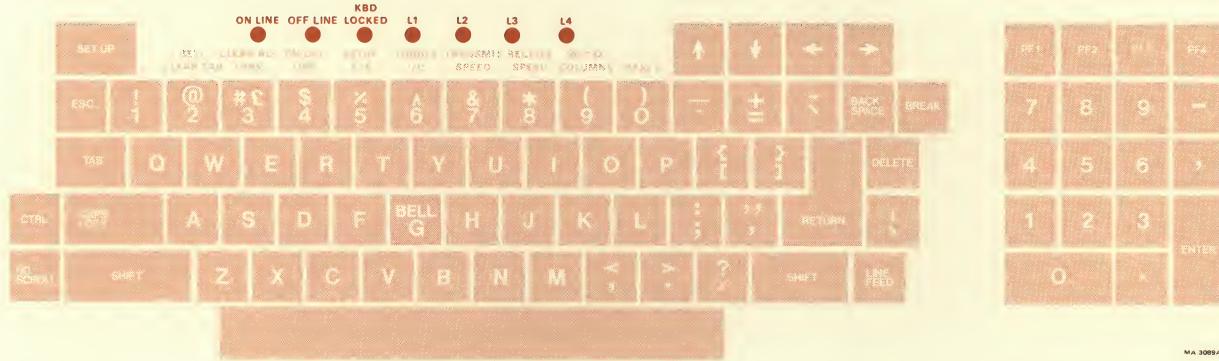


Figure 1-8 Keyboard Indicators

Keyboard Indicators

The following paragraphs describe the function of each keyboard indicator shown in Figure 1-8.

ON LINE

This indicator is on when the terminal is on-line and can communicate with the computer. Either ON LINE or OFF LINE is on when power is on.

OFF LINE

This indicator is on when the terminal is off-line and cannot communicate with the computer. When off-line, characters from the keyboard are displayed on the screen. Either ON LINE or OFF LINE is on when power is on.

KBD LOCKED

This indicator is on during a keyboard locked condition. A keyboard locked condition means the keyboard character buffer is full and cannot accept characters from the keyboard. The keyboard character buffer holds character codes from the keyboard before they are transmitted to the computer (Figure 1-1). When KBD LOCKED is on, characters from the keyboard are lost. If the keyclick SET-UP feature is on, keyclicks are not generated as keys are pressed.

NOTE: The terminal can receive characters from the computer during the keyboard locked condition.

The keyboard locked condition ends when characters in the keyboard character buffer are transmitted to the computer. After the characters have been transmitted, KBD LOCKED turns off and keyclicks can be generated (if the keyclick SET-UP feature is on).

The keyboard locked condition also ends after entering and exiting SET-UP. However, entering and exiting SET-UP with KBD LOCKED on, erases the characters held in the keyboard buffer before they are transmitted.

L1 through L4

These indicators are controlled by the computer and are defined by the computer software.

Audible Indicators

There are three audible indicators: a keyclick, a bell tone, and a series of bell tones. The following paragraphs describe these indicators.

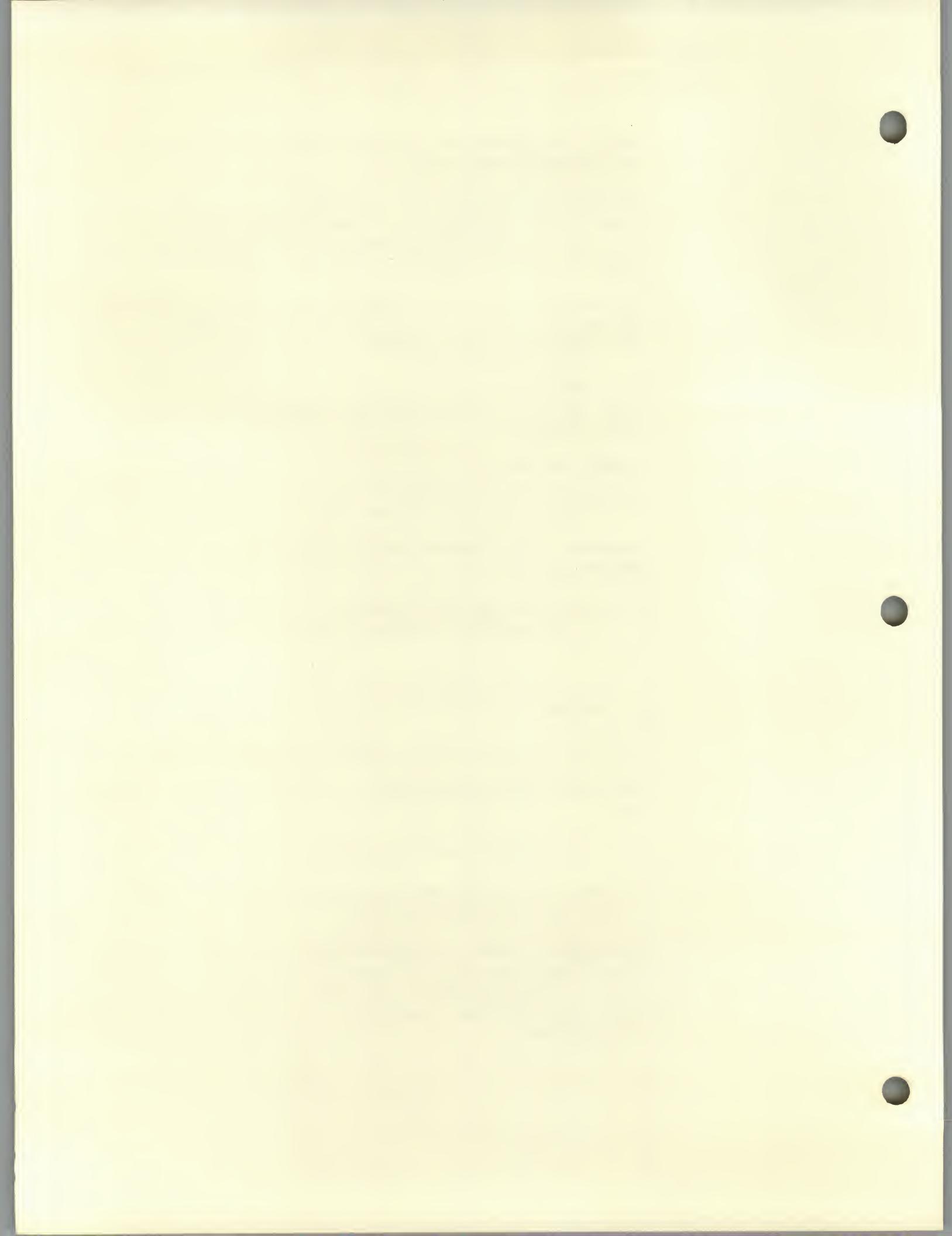
Keypress – The terminal generates a keyclick when a key is pressed, with the following exceptions.

- **SHIFT** and **CTRL** do not generate keyclicks because they do not generate characters. They modify the characters generated by other keys.
- When the KBD LOCKED indicator is on; characters from the keyboard are lost.
- When the keyclick SET-UP feature is off no keyclicks are generated.

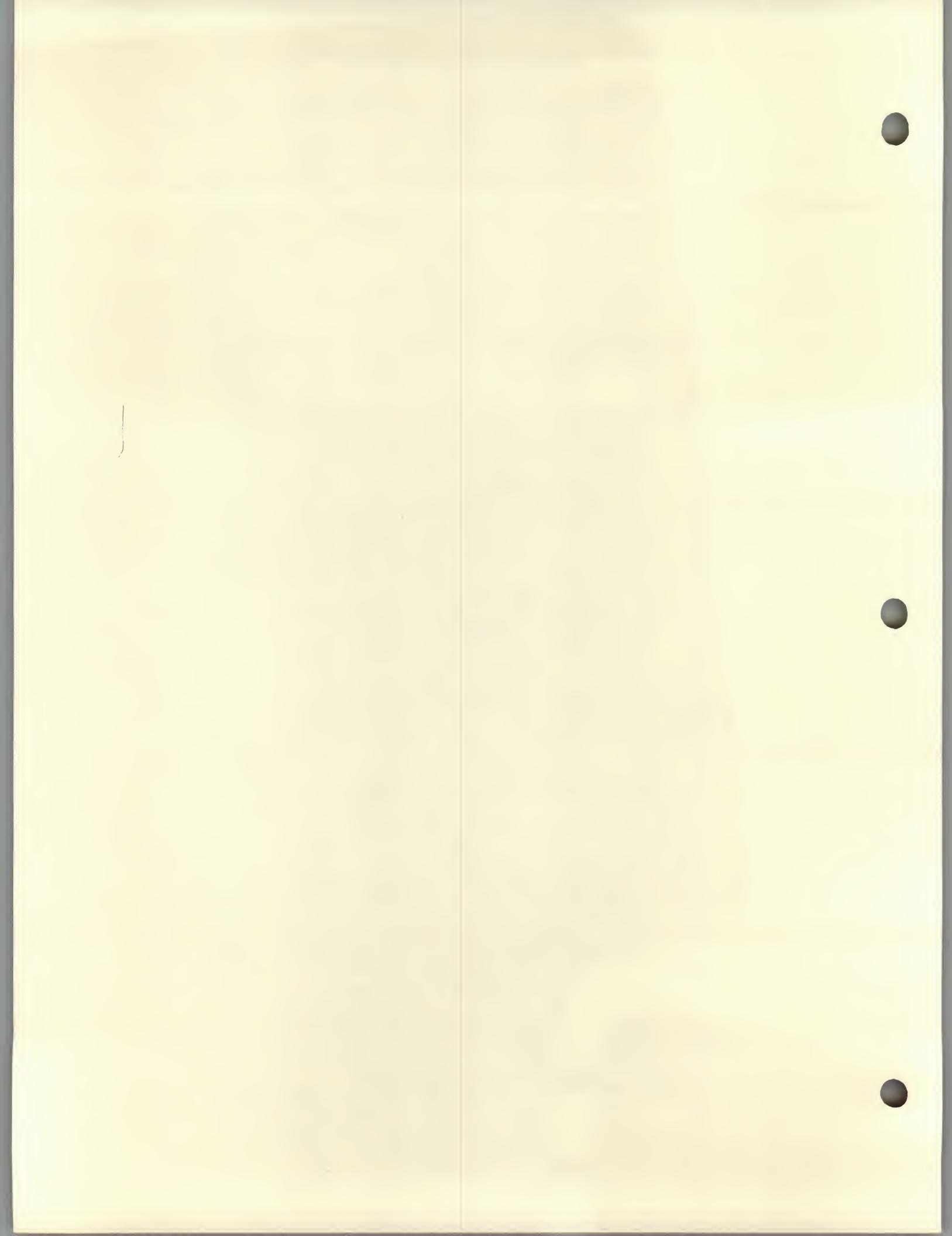
Bell Tone – The terminal generates a bell tone in each of the following cases:

- When a bell character is received from the computer.
- When the cursor is eight characters away from the right margin and the margin SET-UP feature is on.

Series of Bell Tones – The terminal generates a series of bell tones to indicate difficulty in storing or recalling the SET-UP features in user memory. If the terminal has difficulty, it automatically uses the default SET-UP feature selections. Refer to Chapter 2 for more information about the SET-UP feature memories.



SET-UP Features



SET-UP FEATURES

GENERAL

The terminal has many features selected in SET-UP that configure the terminal for specific applications. This chapter describes SET-UP and each of the SET-UP features.

SET-UP

SET-UP allows features to be selected by the keyboard. When the terminal is in SET-UP, the current feature selections are shown on the screen. Two SET-UP displays show the feature selections: SET-UP A and SET-UP B (Figure 2-1). The first display (SET-UP A) shows the location of the tab stops selected in the terminal. A visual ruler numbers each column of the line. The second display (SET-UP B) shows the other SET-UP features.

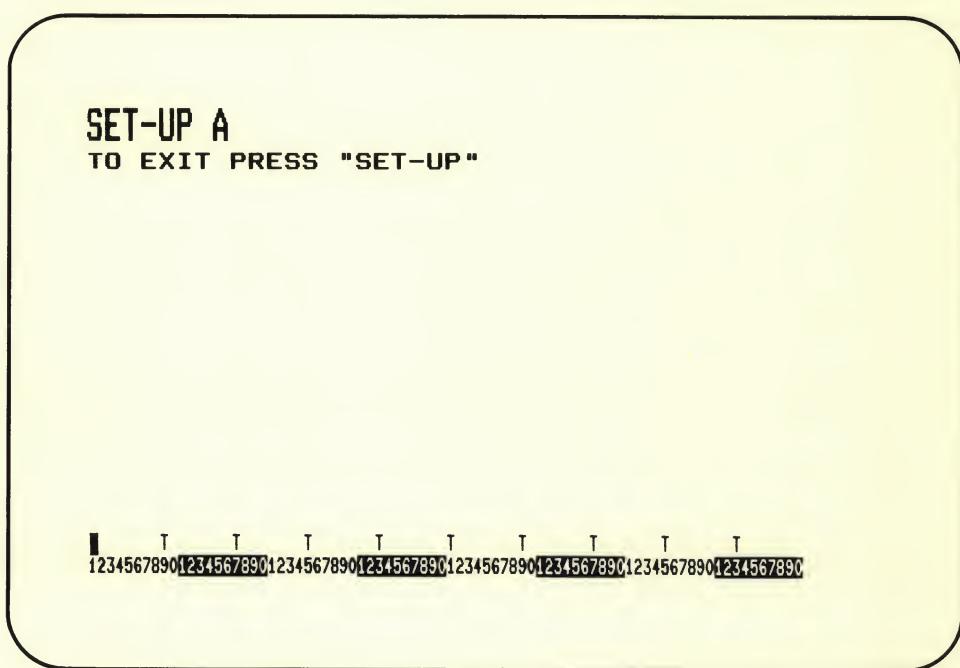


Figure 2-1a SET-UP A Display

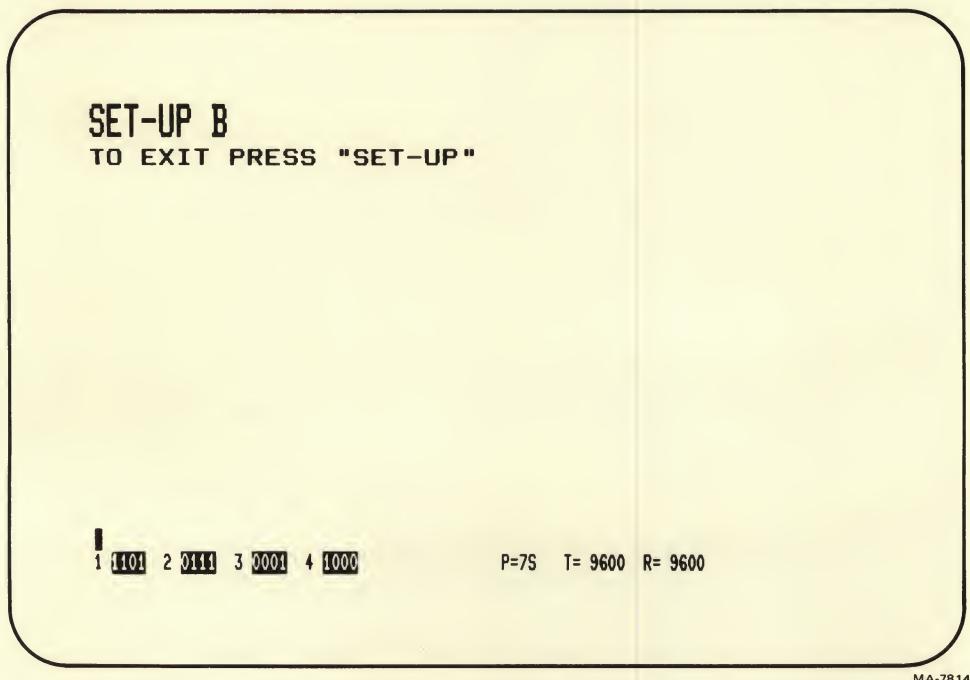


Figure 2-1b SET-UP B Display

SELECTING FEATURES

SET-UP features are selected by either the keyboard or computer. When features are selected by the keyboard, the terminal must be in SET-UP. SET-UP is entered while either on-line or off-line.

Entering SET-UP with the KBD LOCKED indicator on, erases the keyboard character buffer before it is transmitted to the computer. The KBD LOCKED indicator is turned off. Use the following general procedure to change the SET-UP feature selections from the keyboard.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press SETUP A/B to select the correct SET-UP display.	The selected SET-UP display shows on the screen.
Change the SET-UP feature selection.	The SET-UP display shows the feature selection.

Procedure	Indication/Comments
Store the SET-UP features, if desired.	The terminal displays "Wait" and then SET-UP A.
Press SET-UP to exit SET-UP.	Usually, characters displayed on the screen before entering SET-UP are not lost. These characters are displayed on the screen after exiting SET-UP.

Some SET-UP features can be selected by the computer. The following is a list of SET-UP features that can be changed by the computer. (Refer to Chapter 4 for more information about how the computer selects features.)

Columns per line	ANSI/VT52
Tab stops	US/UK character set
Scroll	Auto wrap
Auto repeat	Linefeed/new line
Screen background	Interlace

FEATURE MEMORIES

The SET-UP feature selections are held in three SET-UP feature memories: operating (temporary), user, and default (Figure 2-2).

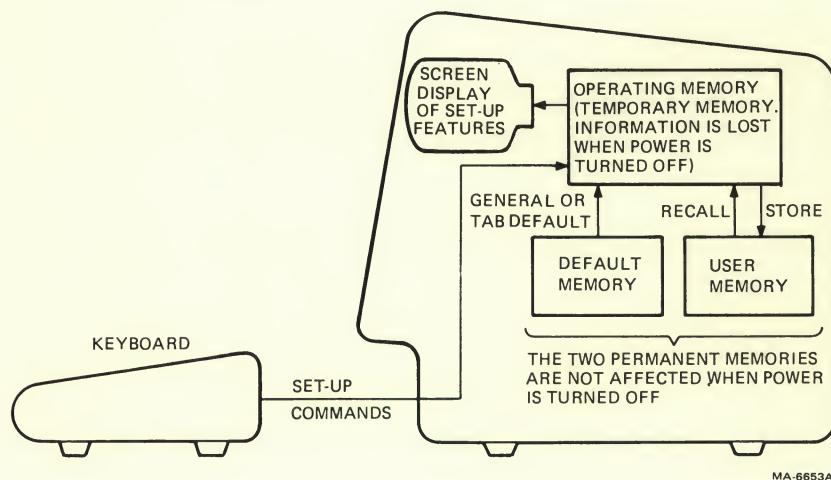


Figure 2-2 SET-UP Feature Memories

Operating Memory

The terminal operates according to the SET-UP feature selections in this memory. These features are selected by either the keyboard or computer. The feature selections in this memory are shown by the SET-UP displays.

Operating memory features are replaced by user memory features during a recall, reset, or when the terminal is turned on (powered up). Use the following procedure to change the feature selections in this memory from the keyboard.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press SETUP A/B to select the correct SET-UP display.	The selected SET-UP display shows on the screen.
Change the SET-UP feature selection.	The SET-UP display shows the feature selection.
Press SET-UP to exit SET-UP.	The terminal operates according to the new SET-UP feature selections in operating memory.

User Memory

This memory holds SET-UP feature selections that replace operating memory features during a recall, reset, or power-up. This is a nonvolatile memory, so turning off the power does not affect SET-UP features in user memory. When the terminal is on, SET-UP features are moved between operating memory and user memory using store, recall, or reset procedures.

Store – This procedure enters operating memory SET-UP feature selections into user memory. Store is performed by the terminal keyboard, the computer does not have a store procedure. Use the following procedure to store SET-UP feature selections in user memory.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Hold down SHIFT and press S to store the features.	The terminal displays wait while entering the feature selections into user memory. When the features are stored, SET-UP A is displayed.
Press SET-UP to exit SET-UP.	Characters displayed on the screen when entering SET-UP are displayed.

Recall – This procedure recalls user memory SET-UP feature selections into operating memory. All features previously in operating memory are erased. Use the following procedure to recall the SET-UP features from user memory into operating memory.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Hold down SHIFT and press R to recall the features.	The terminal erases the screen and displays wait while recalling the feature selections from user memory. When the features are recalled the input and keyboard character buffers are erased, and SET-UP A is displayed on the screen.
Press SET-UP to exit SET-UP.	The characters displayed on the screen before entering SET-UP are lost. When exiting SET-UP, the screen is blank.

Reset – This procedure causes the terminal to perform self-test and recall the user memory feature selections. All feature selections previously in operating memory are erased. Use the following procedure to reset the terminal.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press RESET to reset the terminal.	<p>When reset is performed:</p> <ul style="list-style-type: none"> • The terminal disconnects from the communication line. • The input and keyboard character buffers are erased. • The power-up self-test is performed. • A recall is performed automatically and the terminal operates according to the SET-UP feature selections in user memory. • The terminal automatically exits SET-UP. The characters displayed on the screen before entering SET-UP are erased, the screen is blank.

Default Memory

This memory holds default SET-UP feature selections for all SET-UP features. Default SET-UP feature selections are typical feature selections used by the terminal. The feature selections in default memory cannot be changed by the user. When a default occurs, operating memory SET-UP feature selections change to default selections. There are two types of default selections: general and tab default. The SET-UP features in user memory are not changed by a default. A default occurs when the terminal cannot read the user memory, or it is selected by the keyboard.

General Default – This changes all SET-UP features in the operating memory to the selections in default memory. SET-UP A features are set to 80 columns per line with a tab stop every eighth column. SET-UP B default features are shown in Figure 2-3. The terminal is off-line and the answer-back message is erased from operating memory. Use the following procedure to select a general default from the keyboard.

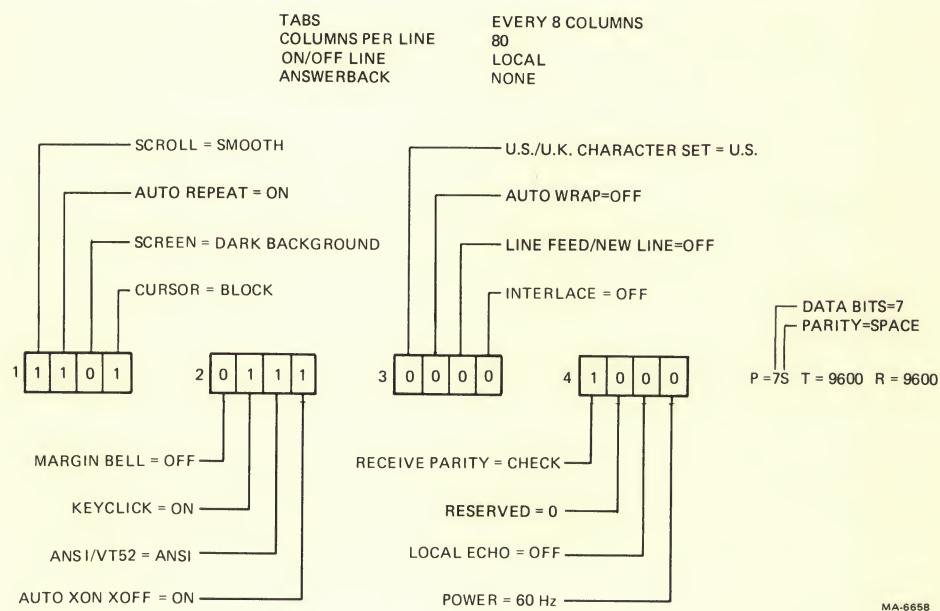


Figure 2-3 SET-UP B Default Feature Selections

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Hold down SHIFT and press D to select a general default.	When a general default is selected: <ul style="list-style-type: none"> • The input and keyboard character buffers are erased. • SET-UP A is displayed. • The terminal operates according to the SET-UP feature selections in default memory.
Press SET-UP to exit SET-UP.	The characters displayed on the screen before entering SET-UP are lost, the screen is blank.

Tab Default – This clears all terminal tab stop settings and sets a new tab stop at every eighth column. Use the following procedure to select a tab default from the keyboard.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Hold down SHIFT and press T to select a tab default.	Tab stops are set at every eighth character position in SET-UP A.
Press SET-UP to exit SET-UP.	Characters displayed on the screen when entering SET-UP are displayed.

FEATURE TYPES

SET-UP features change how the terminal operates. These features allow the terminal to be configured to operator preferences, and they provide compatibility to the computer and ac power source. Table 2-1 divides the SET-UP features into three general types: operator preference, communication compatibility, and installation.

Operator Preference Features

These features configure the terminal to operator preferences. They do not affect information transferred between the terminal and the computer.

Communication Compatibility Features

These features configure the terminal to be compatible with a computer. Many combinations of SET-UP features are used when communicating with a computer. The features must be selected correctly for the terminal to communicate with the computer. An error in these selections may stop communication or cause incorrect information to be transferred between the terminal and computer.

NOTE: This chapter describes the SET-UP features used to provide compatibility. More information about using these SET-UP features is provided in Chapter 5.

Installation Features

These features configure the terminal for operation in different installations. If the location of the terminal is changed, you must verify these feature selections.

Table 2-1 SET-UP Feature Types

Feature	Operator Preference	Communication Compatibility	Installation
ON/OFF line		X	
Screen brightness	X		
Columns per line		X	
Tab stops		X	
Scroll	X	X	
Auto repeat	X		
Screen background	X		
Cursor	X		
Margin bell	X		
Keypress	X		
ANSI/VT52		X	
Auto XON/XOFF		X	
US/UK character set		X	
Auto wrap		X	
Line feed/new line		X	
Interlace			X
Receive parity		X	
Local echo		X	
Power			X
Data/parity bits		X	
Transmit speed		X	
Receive speed		X	
Answerback		X	

FEATURE DESCRIPTIONS

The SET-UP feature descriptions are arranged according to the SET-UP display in which they appear. There are three types: general SET-UP features (features changed in any SET-UP display), SET-UP A features, and SET-UP B features.

A general procedure for changing each SET-UP feature in the SET-UP display is provided at the beginning of each SET-UP display section. For features needing a more detailed procedure, the procedure is provided with the SET-UP feature description.

General SET-UP Features

The on/off-line and screen brightness SET-UP features may be changed in any SET-UP display. Dedicated keys are used to select these features. Each feature description includes the specific procedure used to select the feature.

On/Off Line – This feature places the terminal either on-line or off-line (Figure 2-4). While on-line, the keyboard ON LINE indicator is on and the terminal can communicate with the computer. Keyboard entries are transmitted to the computer and characters received from the computer are displayed on the screen.

When switched off-line, the terminal disconnects from the communication line, and erases both the input and keyboard character buffer. While off-line, the keyboard OFF LINE indicator is on and the terminal cannot communicate with the computer. Keyboard entries are not transmitted but are displayed on the screen. Use the following procedure to select either on-line or off-line.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press ON/OFF LINE to select on-line or off-line.	The ON LINE or OFF LINE indicator shows the feature selection.
Press SET-UP to exit SET-UP.	Characters displayed on the screen when entering SET-UP are displayed.

Screen Brightness – This feature adjusts the brightness of the terminal screen. The ↑ (up arrow) increases screen brightness and the ↓ (down arrow) decreases screen brightness. Use the following procedure to adjust screen brightness.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press ↑ (up arrow) or ↓ (down arrow) to adjust brightness.	The SET-UP display shows the brightness.
Press SET-UP to exit SET-UP.	Characters displayed on the screen when entering SET-UP are displayed.

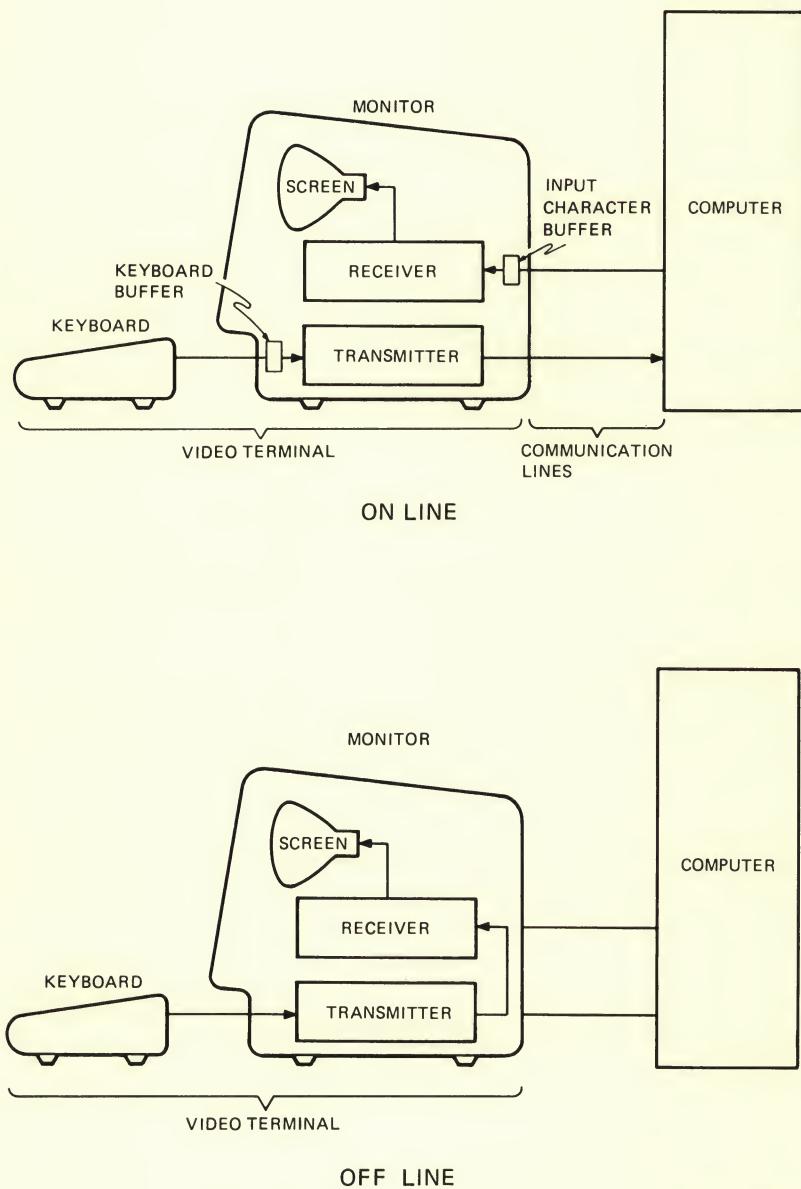


Figure 2-4 ON/OFF Line General Block Diagram

MA-7816A

SET-UP A Features

The SET-UP A display is similar to Figure 2-5. The display summarizes the number of columns per line and tab stop feature selections. The bottom line of the display is a ruler that numbers each column position on a line. Each tab stop is shown by a T above the ruler. SET-UP A features are selected using dedicated keys. Each feature description includes the specific procedure used to select the feature.

Columns Per Line – This feature selects a display of either 80 or 132 columns per line. When 80 columns per line is selected, the screen is 80 columns wide and 24 lines long. When 132 columns per line is selected, the screen is 132 columns wide and 14 lines long. The displayed lines are the same width on the screen, but the columns are closer together when using 132 columns per line (Figure 2-6). Use the following procedure to select the number of columns per line.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press 80 / 132 COLUMNS to select the number of columns per line.	The bottom line of the display is a ruler that numbers each column on a line. This ruler shows the feature selection.
Press SET-UP to exit SET-UP. OR	Characters displayed on the screen when entering SET-UP are lost. When exiting SET-UP the screen is blank.
Press SETUP A/B to enter SET-UP B.	SET-UP B is displayed.

Tab Stops – Tab stops are column positions selected on lines of the terminal screen. The cursor can tab (advance) to the column with the tab stop. Tab stops can be changed one at a time, or all tabs stops can be cleared and then set one at a time.

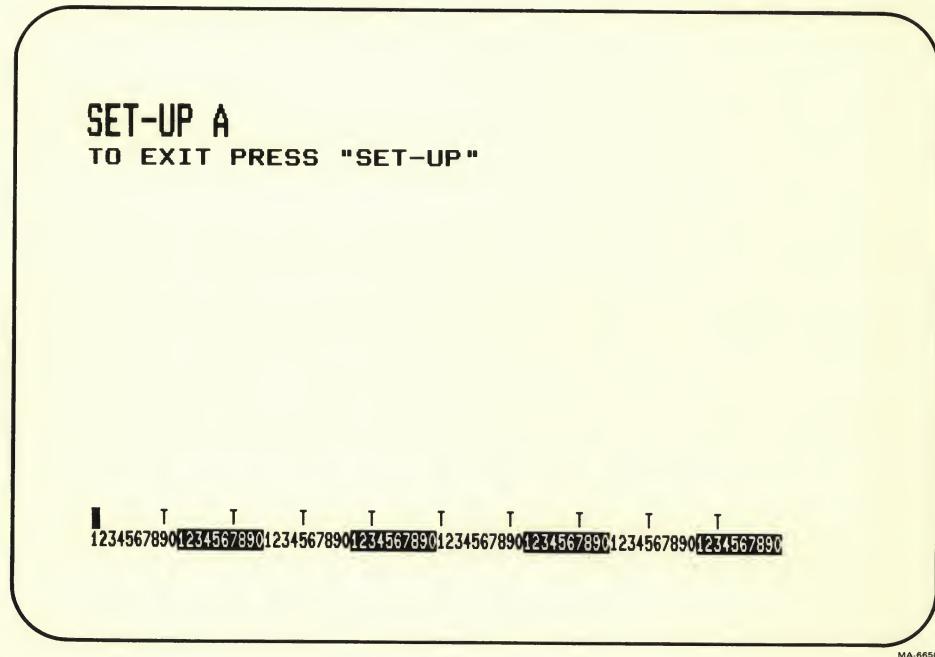


Figure 2-5 SET-UP A Display

These are characters displayed using 80 columns.

These are characters displayed using 132 columns.

Figure 2-6 80- and 132-Column Displays

SET/CLEAR TAB sets and clears each tab stop one at a time. **CLEAR ALL TABS** clears all tab stops. A tab default is provided to set a tab stop at every eighth column position. (Refer to the Feature Memories section of this chapter for more information about tab default.) Use the following procedure to select tab stops.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press CLEAR ALL TABS .	All tabs are cleared.
OR	
Press SET/CLEAR TABS to select tab stops.	Tabs selected by the cursor are set or cleared. the cursor is moved by using ← (left arrow), → (right arrow), RETURN , TAB , and space bar.
Press SET-UP to exit SET-UP.	Characters displayed on the screen when entering SET-UP are displayed.
OR	
Press SETUP A/B to enter SET-UP B.	SET-UP B is displayed.

SET-UP B Features

SET-UP B can only be entered from SET-UP A. The SET-UP B display is similiar to Figure 2-7. Figure 2-8 summarizes the SET-UP B display features. The bottom line of the display shows groups of switches indicating the features selected. Also, the data/parity bits, transmit speed, and receive speed feature selections are shown.

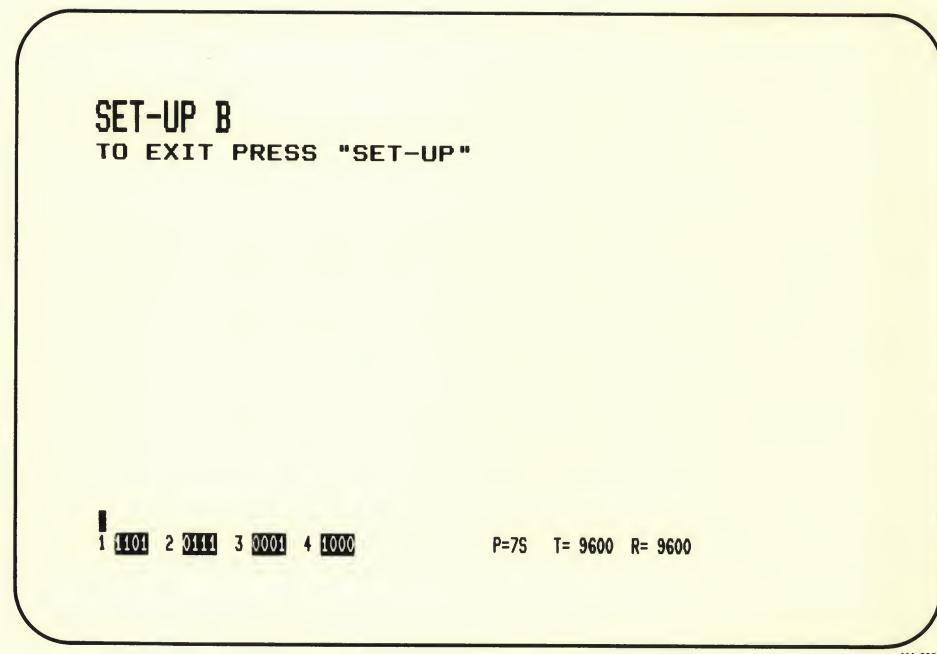


Figure 2-7 SET-UP B Display

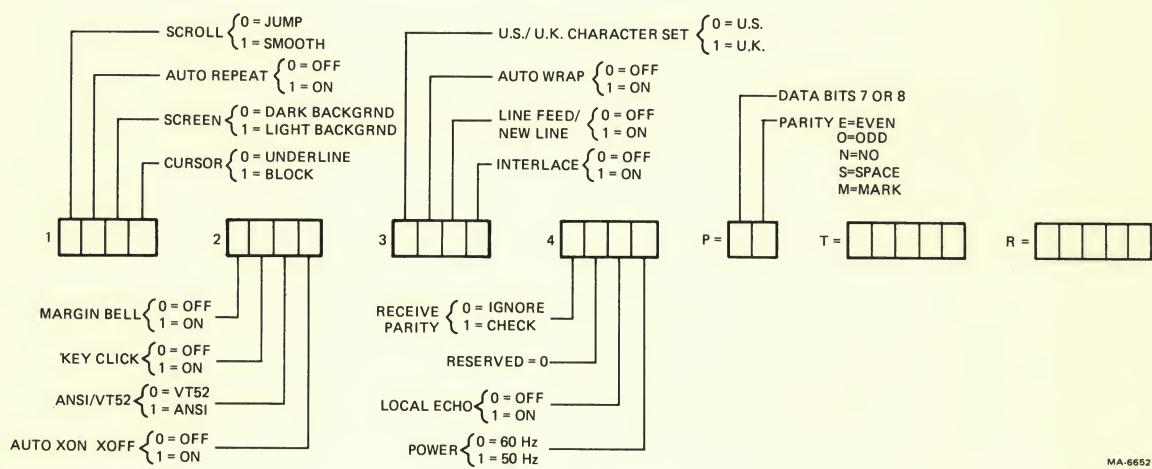


Figure 2-8 SET-UP B Summary

The data/parity bits, transmit speed, and receive speed features are selected using dedicated keys. The procedure to select these features is provided with the feature descriptions. All other SET-UP B features are selected using SET-UP switches. Use the following procedure to change SET-UP feature switch selections.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press SETUP A/B to enter SET-UP B.	SET-UP B is displayed.
Position the cursor over the SET-UP feature switch to be changed.	The cursor is moved using \leftarrow (left arrow), \rightarrow (right arrow), RETURN , TAB , and space bar.
Press TOGGLE 1/0 to select feature.	The screen displays feature the selection.
Press SET-UP to exit SET-UP.	Characters displayed on the screen when entering SET-UP are displayed.
OR	
Press SETUP A/B to enter SET-UP A.	SET-UP A is displayed.

The following paragraphs describe the features in the order of the SET-UP switches on the screen. The switches are referenced by group and number. (Example: switch 3-2 is the third group of switches - second switch counting from left to right.) Following these features the parity/data bits, transmit speed, and receive speed features are described. The answer-back feature is described at the end of the feature descriptions.

Scroll (Switch 1-1: 0=Jump, 1=Smooth) - Scrolling is the upward or downward movement of existing lines on the screen. Scrolling makes room for new lines at the bottom or top of the screen. It can be performed in two ways: jump scroll, or smooth scroll.

With jump scroll selected, new lines are displayed on the screen as fast as they are received. With smooth scroll selected, the speed at which new lines can be displayed is limited. Therefore, the movement of lines occurs at a smooth steady rate.

Auto Repeat (Switch 1-2: 0=Off, 1=On) – This feature determines if keys automatically repeat, when held down for more than one-half second. Keys auto repeat at the rate of about 30 times per second. Auto repeat affects all keyboard keys except the following: **SET-UP, ESC, RETURN, ENTER, NO SCROLL**, and **CTRL** with another key. When the feature is off, keys do not auto repeat.

Screen Background (Switch 1-3: 0=Dark, 1=Light) – This feature selects the type of screen background (Figure 2-9). With dark background selected, the display has light characters on a dark background. With light background (reverse screen) selected, the display has dark characters on a light background.

Cursor (Switch 1-4: 0=Underline, 1=Block) – This feature provides a choice between two cursor displays. The cursor indicates the active position (where the next character is displayed). The cursor is displayed as either a blinking underline (—) or a blinking block (■).

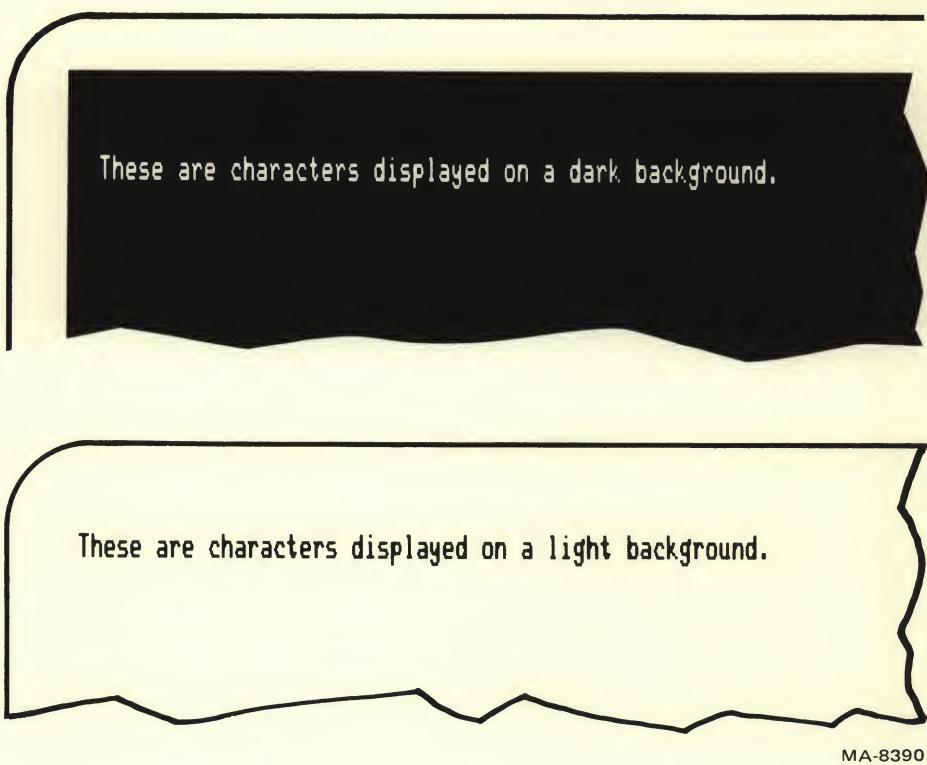


Figure 2-9 Screen Background

Margin Bell (Switch 2-1: 0=Off, 1=On) – This feature generates a bell tone when the cursor moves past the eighth character position from the end of the line. The margin bell can be turned on or off. Margin bell volume is not adjustable.

NOTE: This feature is used when typing text, as in a typewriter. It may give unexpected results when performing other functions.

Keypress (Switch 2-2: 0=Off, 1=On) – Keypress is a sound generated each time a key is pressed, except for **SHIFT** and **CTRL**. Keypress can be turned on or off, however people usually prefer this feature on. Keypress volume is not adjustable.

Keypresses are not generated during a keyboard locked condition. The keyboard is locked when the KBD LOCKED indicator is on. Refer to Chapter 1 for more information about the KBD LOCKED indicator.

ANSI/VT52 (Switch 2-3: 0=VT52, 1=ANSI) – The terminal follows two different standards for processing control functions: American National Standards Institute (ANSI), and VT52 compatible. With ANSI selected, the terminal generates and responds to control functions per ANSI standards X3.41-1974 and X3.64-1979. With VT52 compatible selected, the terminal is compatible with previous DIGITAL software using the VT52 video terminal. Refer to Chapter 4 for more information about received characters and control functions.

Auto XON/XOFF (Switch 2-4: 0=Off, 1=On) – When the terminal receives a character (other than NUL), the character is placed in an input character buffer. The buffer holds the received character until the terminal processes the character. When processed, the character is removed from the input character buffer.

If received characters are placed in the input character buffer faster than they are processed, the input character buffer begins to fill. Also, entering SET-UP stops the terminal from taking characters from the input buffer. This causes received characters to fill the input buffer and may eventually cause the loss of characters. When the buffer is full, characters received are lost and the substitute character (¶) is displayed.

The auto XON/XOFF feature prevents the loss of received characters. When the feature is on, the terminal transmits XON and XOFF to indicate that the input character buffer is almost full or empty. When the input character buffer is almost full, the terminal transmits XOFF (DC3). The computer should stop transmitting characters.

As the terminal continues to process (remove) characters from the input character buffer, the number of characters in the buffer decreases. When the input buffer is almost empty, the terminal transmits XON (DC1). The computer can continue transmitting characters.

When the auto XON/XOFF feature is off, the terminal does not use XON and XOFF to prevent the loss of received characters. NO SCROLL, which uses XON and XOFF, does not function.

NOTE: Regardless of the auto XON/XOFF feature selection, the terminal always stops transmitting characters when an XOFF is received. The terminal continues transmitting characters when an XON is received.

US/UK Character Set (Switch 3-1: 0=#, 1=£) – This feature selects either the United States or United Kingdom character sets. The difference between the two character sets is one character, the # (number) or £ (pound) symbol.

Auto Wrap (Switch 3-2: 0=Off, 1=On) – This feature selects where the next received character is displayed when the cursor is at the right margin. When the feature is off, the character and all following characters are written into the last column of the current line. When the feature is on, the character is automatically displayed on the next line.

Linefeed/New Line (Switch 3-3: 0=Off, 1=On) – This feature selects character(s) transmitted by RETURN. This feature also determines the action taken by the terminal when receiving a linefeed.

When the feature is off, pressing RETURN generates a carriage return (CR). When a linefeed (LF) is received, the cursor moves down to the next line maintaining the current column position.

When the feature is on, pressing RETURN generates a carriage return (CR) and linefeed (LF). When a linefeed is received, the cursor moves to the left margin of the next line.

NOTE: The terminal processes form feed (FF) and vertical tab (VT) as linefeed (LF). The linefeed/new line feature affects the action taken when receiving form feed and vertical tab.

Interlace (Switch 3-4: 0=Off; 1=On) – This feature selects the number of scan lines used to create characters on the screen. When on, the terminal uses 480 scan lines per screen. When off, the terminal uses 240 scan lines per screen. This feature does not add any new information to the screen. However, when on, the feature may improve the output of hardcopy or video devices connected to the video output connector. Usually operators prefer to have this feature off.

Receive Parity (Switch 4-1: 0=Ignore, 1=Check) – This feature either checks or ignores the parity bit of received characters. If the feature is set to check, the parity bit of the received characters is checked according to the parity feature. The terminal can check received characters for either odd or even parity. Mark and space parity are not checked.

If a receive parity error occurs, the terminal displays the substitution character (☒) in place of the character with the error. When the feature is set to ignore, any parity bit received is ignored.

Reserved (Always = 0) (Switch 4-2)

Local Echo (Switch 4-3: 0=Off; 1=On) – When this feature is on, every character transmitted to the computer is also automatically displayed on the screen (Figure 2-10). The computer does not have to transmit (echo) the character back to the terminal for display. When this feature is off, characters are only transmitted to the computer. The computer must transmit them back to the terminal for display.

Power (Switch 4-4: 0=60 Hz, 1=50 Hz) – This feature must be selected to match the power line frequency. The feature is selected to reduce screen flicker.

Data/Parity Bits – This feature selects two separate but related communication features: data bits per character, and parity. Data bits per character determines the number of data bits in each character, either seven or eight bits. However, when eight bits is selected, the eighth data bit is always a space (or 0) for characters transmitted. The eighth data bit of received characters is ignored.

Parity determines the type of parity bit the terminal generates when transmitting and receiving characters. However, to check the parity of received characters, the receive parity feature must be set to check. When receive parity is used, and the parity selection must be either odd or even. Mark and space parity cannot be checked.

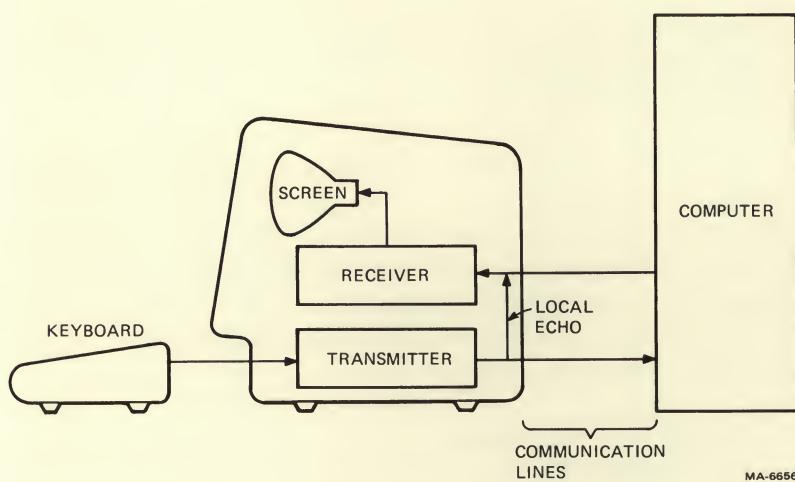


Figure 2-10 Local Echo

If no parity is selected, the parity bit is not included in the transmitted character and ignored in received characters. The terminal uses one of the data bits per character/parity combinations shown in Table 2-2. Use the following procedure to select the data/parity feature.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press SETUP A/B to enter SET-UP B.	SET-UP B is displayed.
Hold down SHIFT and press P to select the feature.	The terminal displays the feature selection.
Press SET-UP to exit SET-UP.	Characters displayed on the screen when entering SET-UP are displayed.
OR	
Press SETUP A/B to enter SET-UP A.	SET-UP A is displayed.

Table 2-2 Data/Parity Bits Selections

P=	Data Bits per Character	Parity
7M	7	Mark
7S	7	Space
7O	7	Odd
7E	7	Even
7N	7	No parity bit
8O	8	Odd
8E	8	Even
8N	8	No parity bit

Transmit Speed – This feature selects the speed (baud rate) and number of stop bits for characters transmitted by the terminal. The feature must be set to match the computer receive speed. The terminal's transmit and receive speeds are not related. The terminal can transmit characters at one speed and receive characters at a different speed. The number of stop bits is automatically selected when the transmit speed is set. Table 2-3 lists the transmit speed and number of stop bits used by the terminal. Use the following procedure to select the transmit speed.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press SETUP A/B to enter SET-UP B.	SET-UP B is displayed.
Press TRANSMIT SPEED to select the transmit speed.	The terminal displays the feature selection.
Press SET-UP to exit SET-UP.	Characters displayed on the screen when entering SET-UP are displayed.
OR	
Press SETUP A/B to enter SET-UP A.	SET-UP A is displayed.

Table 2-3 Transmit Speed and Number of Stop Selections

Speed (Baud Rate)	Stop Bits	Speed (Baud Rate)	Stop Bits
50	1	1200	1
75	1	1800	1
110	2	2000	1
134.5	1	2400	1
150	1	3600	1
200	1	4800	1
300	1	9600	1
600	1	19200	1

Receive Speed – This feature selects the speed (baud rate) and number of stop bits in received characters. The feature must be set to match the computer transmit speed. The terminal's receive and transmit speeds are not related. It can receive characters at one speed and transmit characters at a different speed. The number of stop bits is automatically selected when the receive speed is set. Table 2-4 lists the receive speed and number of stop bits used by the terminal. Use the following procedure to select this feature.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press SETUP A/B to enter SET-UP B.	SET-UP B is displayed.
Press RECEIVE SPEED to select the receive speed.	The terminal displays the current feature selection.
Press SET-UP to exit SET-UP.	Characters displayed on the screen when entering SET-UP are displayed.
OR	
Press SETUP A/B to enter SET-UP A.	SET-UP A is displayed.

Table 2-4 Receive Speed and Number of Stop Selections

Speed (Baud Rate)	Stop Bits	Speed (Baud Rate)	Stop Bits
50	1	1200	1
75	1	1800	1
110	2	2000	1
134.5	1	2400	1
150	1	3600	1
200	1	4800	1
300	1	9600	1
600	1	19200	1

Answerback – This feature provides the terminal with a 20-character identifying message that is transmitted to the computer. The answerback message is transmitted under the following conditions.

1. The answerback message is transmitted when a direct request for identification is received from the computer. The computer transmits enquire (ENQ) and the terminal responds with the answerback message. The entire sequence takes place automatically, without affecting the screen or requiring operator action.
2. The operator manually transmits the answerback message from the keyboard. Hold down **CTRL** and press **BREAK** to manually transmit the answerback message.

Use the following procedure to enter the answerback message.

Procedure	Indication/Comments
Press SET-UP to enter SET-UP.	SET-UP A is displayed.
Press SETUP A/B to enter SET-UP B.	SET-UP B is displayed.
Hold down SHIFT and press A .	The terminal displays A = (Figure 2-11).

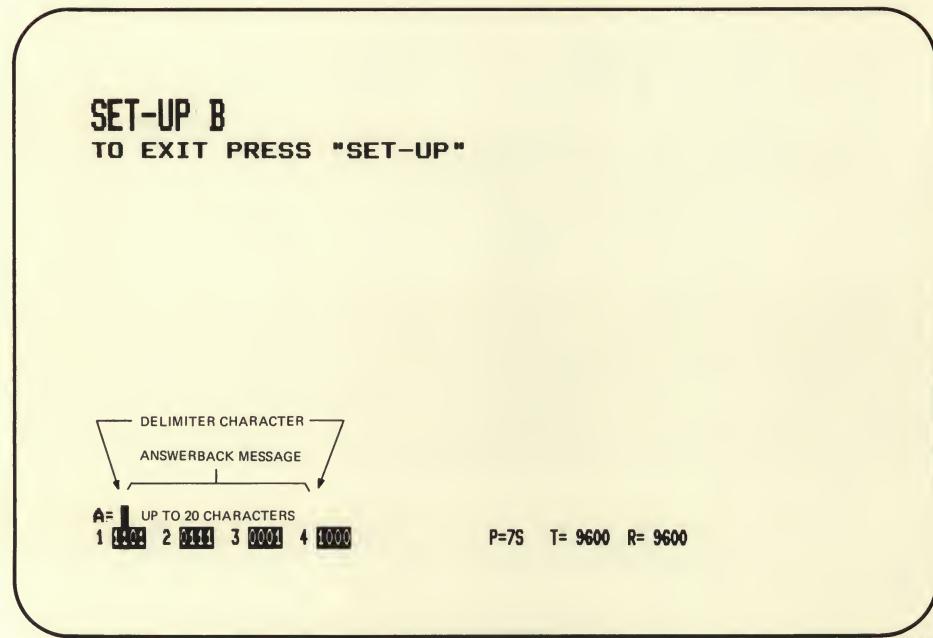
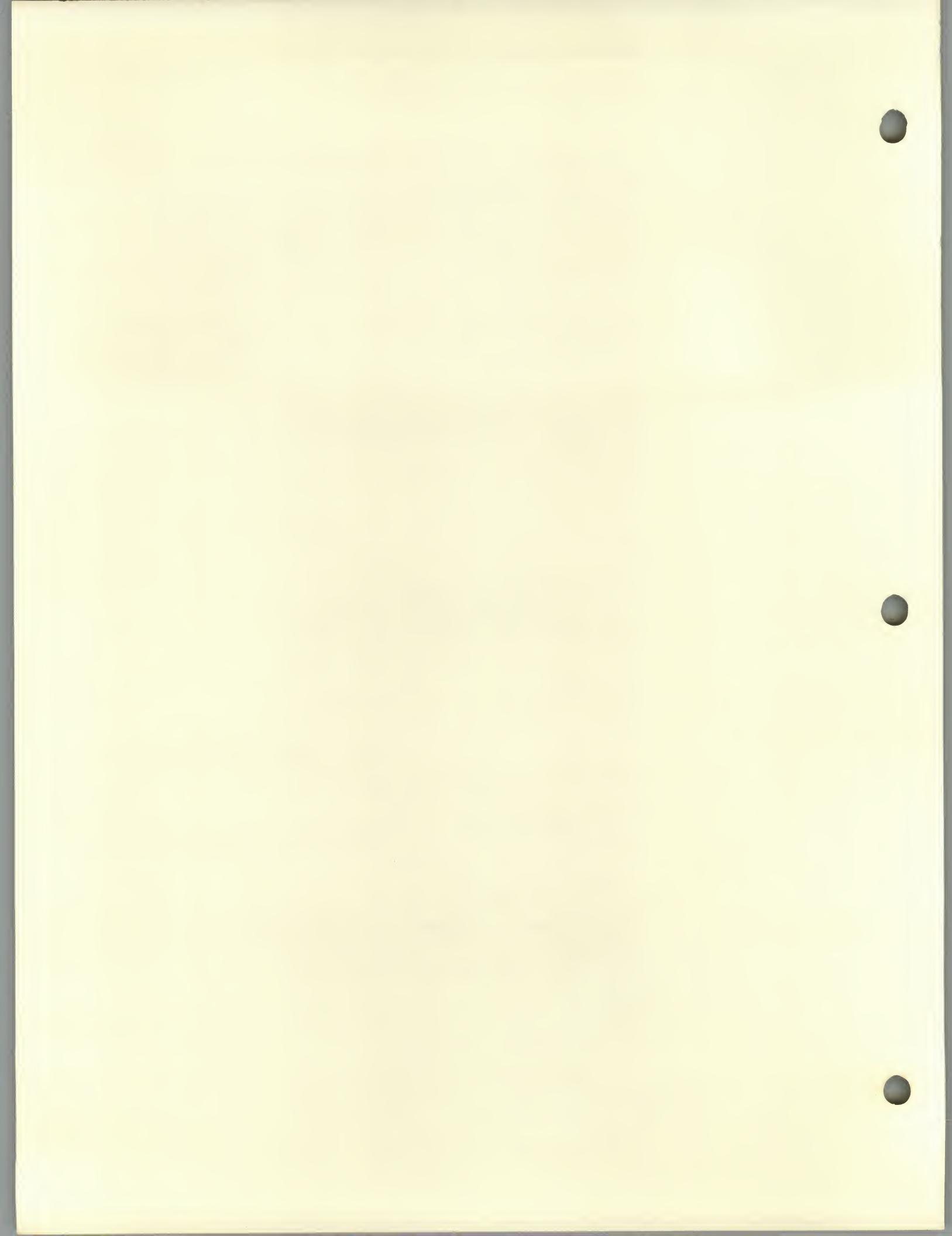
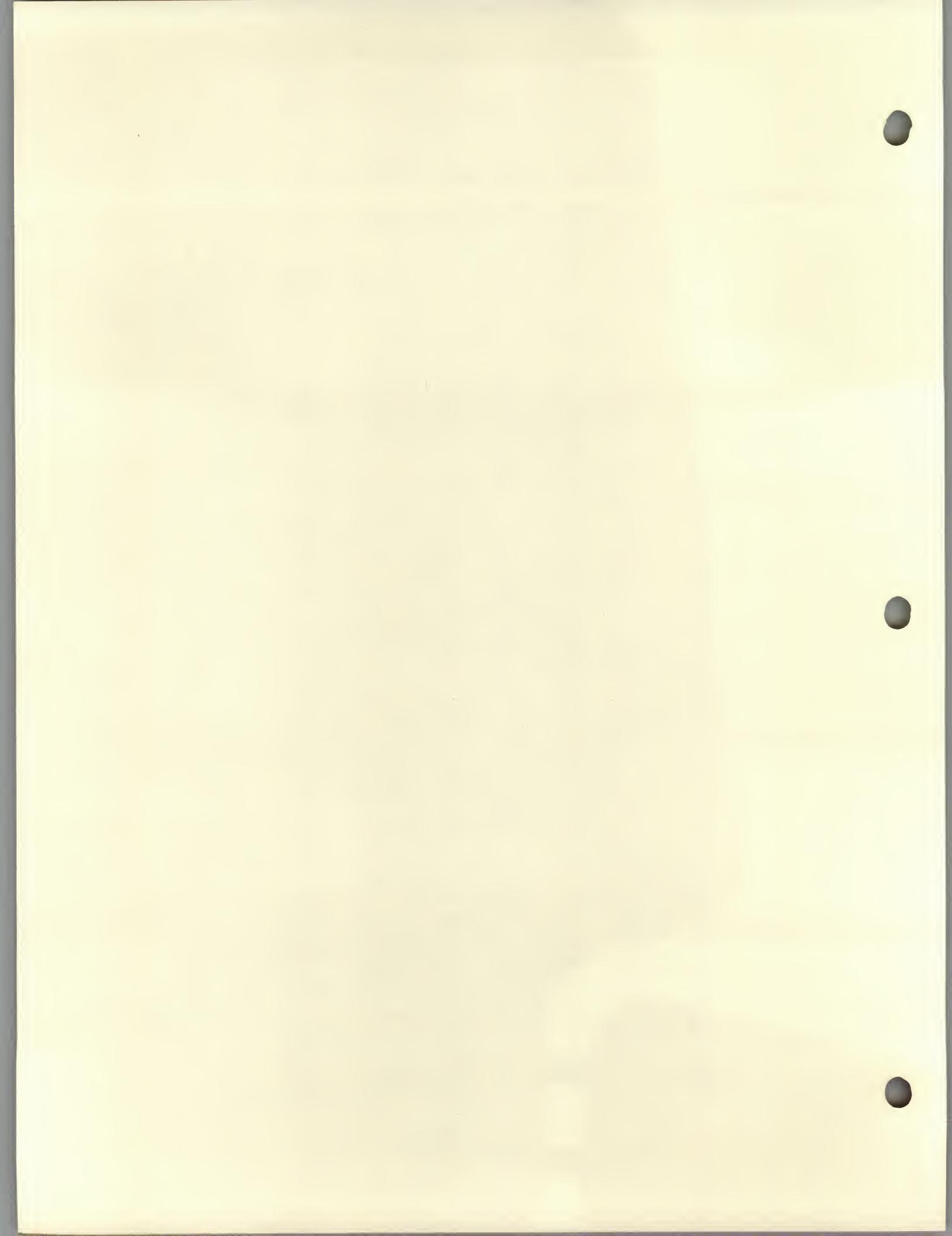


Figure 2-11 Answerback Message Summary

Procedure	Indication/Comments
Type the message delimiter character.	This is any character not used in the answerback message. The message delimiter character is not transmitted as part of the answerback message.
Type the answerback message.	The answerback message may be up to 20 characters. If control characters are used they are displayed as the (♦) character.
	If a mistake is made while typing the message, type the delimiter character already used and return to the third step of this procedure. This is the only way to correct errors in the answerback message.
If less than 20 characters are in the message, type the delimiter character.	If 20 characters are typed, the message is automatically entered into operating memory. If less than 20 characters are typed, the delimiter character is used to enter the message into operating memory.
Press SET-UP to exit SET-UP.	The answerback message can be held in user memory if a store is performed.
OR	Characters displayed on the screen when entering SET-UP are displayed.
Press SETUP A/B to enter SET-UP A.	SET-UP A is displayed.



Transmitted Characters



TRANSMITTED CHARACTERS

3

GENERAL

This chapter describes the characters generated by the terminal. The keys are divided into three groups: standard keys, function keys, and numeric keypad keys.

STANDARD KEYS

The standard keys are shown in Figure 3-1. The terminal generates American Standard Code for Information Interchange (ASCII) characters. Lowercase characters are generated when *neither SHIFT or CAPS LOCK* are down. Uppercase characters are generated when *either SHIFT or CAPS LOCK* are down. **CAPS LOCK** does not affect the nonalphabetic keys.

OCTAL CODES GENERATED BY KEYBOARD (SHIFTED CODES SHOWN ABOVE KEYCAP LEGENDS UNSHIFTED CODES SHOWN BELOW KEYCAP LEGENDS)																
	041 11 061	100 2 @ 062	043 3 # 063	044 4 \$ 064	045 5 % 065	136 6 ^ 066	046 7 & 067	052 8 * 070	050 9 (071	051 0) 060	137 — 055	153 = + 075	176 \ ~ 140			
	121 Q 161	127 W 167	105 E 145	122 R 162	124 T 164	131 Y 171	125 U 165	111 I 151	117 O 157	120 P 160	173 | ( 133	175 | ) 135				
	CAPS LOCK 141	101 A 141	123 S 143	104 D 144	106 F 146	107 G 147	110 H 150	112 J 152	113 K 153	114 L 154	072 ; : 073	042 " " 047			174 \\ 134	
	SHIFT 172	132 Z 172	130 X 170	103 C 143	126 V 166	102 B 142	116 N 156	115 M 155	074 < 054	076 > 056	077 / ? 057	SHIFT				
							040 SPACE 040									

MA-7418A

Figure 3-1 Standard Key Codes

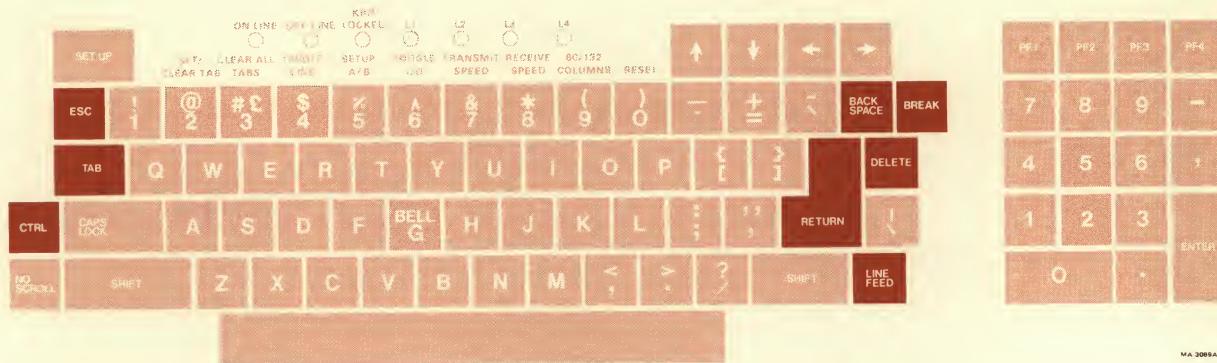


Figure 3-2 Function Keys

FUNCTION KEYS

The function keys are shown in Figure 3-2. These keys generate characters whose function is defined by the computer software or communication system. The following paragraphs describe the function keys.

BREAK

BREAK

This key generates break. The function of break is defined by the computer system. Refer to Chapter 5 for more information about break.

Hold down **SHIFT** and press **BREAK** to generate a long break disconnect. A long break disconnect usually disconnects the terminal from the communication line. Refer to Chapter 5 for more information about long break disconnect.

Hold down **CTRL** and press **BREAK** to transmit the answerback message. Refer to Chapter 2 for more information about the answerback feature.



Cursor Keys

These characters are generated by the terminal and depend on the ANSI/VT52 feature. When the ANSI/VT52 feature is set for ANSI, the cursor keys generate sequences that depend on the cursor key mode selection. Cursor key mode is usually selected by the computer. Refer to Chapter 4 for more information about cursor key character selection. Table 3-1 lists the ANSI and VT52 cursor key characters.

Table 3-1 Cursor Control Key Code

Cursor Key	ANSI Mode			VT52 Mode
	Cursor Key Mode Reset		Cursor Key Mode Set	
↑	ESC [A	033 133 101	ESC O A	ESC A
↓	ESC [B	033 133 102	ESC O B	ESC B
→	ESC [C	033 133 103	ESC O C	ESC C
←	ESC [D	033 133 104	ESC O D	ESC D

Control Character Keys

Figure 3-3 shows the keys that generate control characters. Control characters can be generated in two ways.

1. Hold down **CTRL**, and press any of the unshaded keys in Figure 3-3.
2. Press any of the shaded keys in Figure 3-3 without using **CTRL**. The shaded keys are dedicated keys that generate control characters without using **CTRL**.

Table 3-2 lists the control characters generated by the terminal. No details are provided about the function of the control characters because different computer systems may use each control character differently.

NOTE: The terminal generates some control characters differently than previous DIGITAL terminals (VT52 terminals). Table 3-3 lists the keys used to generate these control characters.

MNEOMONICS SHOWN ABOVE KEYCAP LEGENDS OCTAL CODES SHOWN BELOW KEYCAP LEGENDS															
ESC 033														RS 036	BS 010
HT TAB 011	XON Q 021	ETB W 027	ENQ E 005	DC2 R 022	DC4 T 024	EM Y 031	NAK U 025	HT I 011	SI O 017	DLE P 020	ESC || 033	GS || 035	DEL || 177		
CTRL		SOH A 001	XOFF S 023	EOT D 004	ACK F 006	BEL G 007	BS H 010	LF J 012	VT K 013	FF L 014			CR RETURN 015	FS \\| 034	
		SUB Z 032	CAN X 030	ETX C 003	SYN V 026	STX B 002	SO N 016	CR M 015			US /? 037		LF LINE FEED 012		
											NUL 000				

MA-7419A

Figure 3-3 Function Key Control Codes

Table 3-2 Control Codes Generated

Name	Mnemonic	Code (Octal) Sent	Key Pressed with CTRL	Dedicated Key
Null	NUL	000		
Start of heading	SOH	001	A	
Start of text	STX	002	B	
End of text	ETX	003	C	
End of transmission	EOT	004	D	
Enquire	ENQ	005	E	
Acknowledge	ACK	006	F	
Bell	BEL	007	G	
Backspace	BS	010	H	BACK SPACE
Horizontal tab	HT	011	I	TAB
Linefeed	LF	012	J	LINE FEED
Vertical tab	VT	013	K	
Form feed	FF	014	L	
Carriage return	CR	015	M	RETURN (ENTER)*
Carriage return linefeed	CR LF	015 012		RETURN (ENTER)*
Shift out	SO	016	N	
Shift in	SI	017	O	
Data link escape	DLE	020	P	
Device control 1	DC1 (XON)	021	Q	
Device control 2	DC2	022	R	
Device control 3	DC3 (XOFF)	023	S	
Device control 4	DC4	024	T	
Negative acknowledge	NAK	025	U	
Synchronous idle	SYN	026	V	
End of transmission block	ETB	027	W	
Cancel previous word or character	CAN	030	X	
End of medium	EM	031	Y	
Substitute	SUB	032	Z	
Escape	ESC	033	[
File separator	FS	034	\	
Group separator	GS	035]	
Record separator	RS	036	~	
Unit separator	US	037	?	
Delete	DEL	177		DELETE

* The **RETURN** key character code can be changed by the linefeed/new line feature. When off, this feature causes **RETURN** to generate a single control character (CR). When on, this feature causes **RETURN** to generate two characters (CR, LF). Also, depending on the numeric keypad mode selected, **RETURN** and **ENTER** may generate the same control codes.

Table 3-3 VT101 and Previous DIGITAL Terminal Key Differences

Control Code	VT101 Terminal	Previous Terminal
NUL (octal 000)	CTRL Space bar	CTRL @
RS (octal 036)	CTRL ~	CTRL ^
US (octal 037)	CTRL ?	CTRL -

NUMERIC KEYPAD KEYS

The characters generated by the numeric keypad keys change depending on the selection of the ANSI/VT52 feature and alternate (application) keypad mode. The application keypad mode is usually selected by the computer. Refer to Chapter 4 for more information about keypad character selection.

When application keypad mode is not selected (numeric keypad mode selected), the numeric keypad generates the numeric, comma, period, and minus sign characters used by the main keyboard. When application keypad mode is selected, the numeric keypad generates control functions. Table 3-4 lists the characters generated by the numeric keypad.

Table 3-4 Numeric Keypad Codes

Key	ANSI Mode			VT52 Mode				
	Numeric Keypad Mode	Application Keypad Mode		Numeric Keypad Mode	Application Keypad Mode			
0	0 060	ESC 033	0 117	p 160	0 060	ESC 033	?	p 160
1	1 061	ESC 033	0 117	q 161	1 060	ESC 033	?	q 161
2	2 062	ESC 033	0 117	r 162	2 062	ESC 033	?	r 162
3	3 063	ESC 033	0 117	s 163	3 063	ESC 033	?	s 163
4	4 064	ESC 033	0 117	t 164	4 064	ESC 033	?	t 164
5	5 065	ESC 033	0 117	u 165	5 065	ESC 033	?	u 165
6	6 066	ESC 033	0 117	v 166	6 066	ESC 033	?	v 166
7	7 067	ESC 033	0 117	w 167	7 067	ESC 033	?	w 167

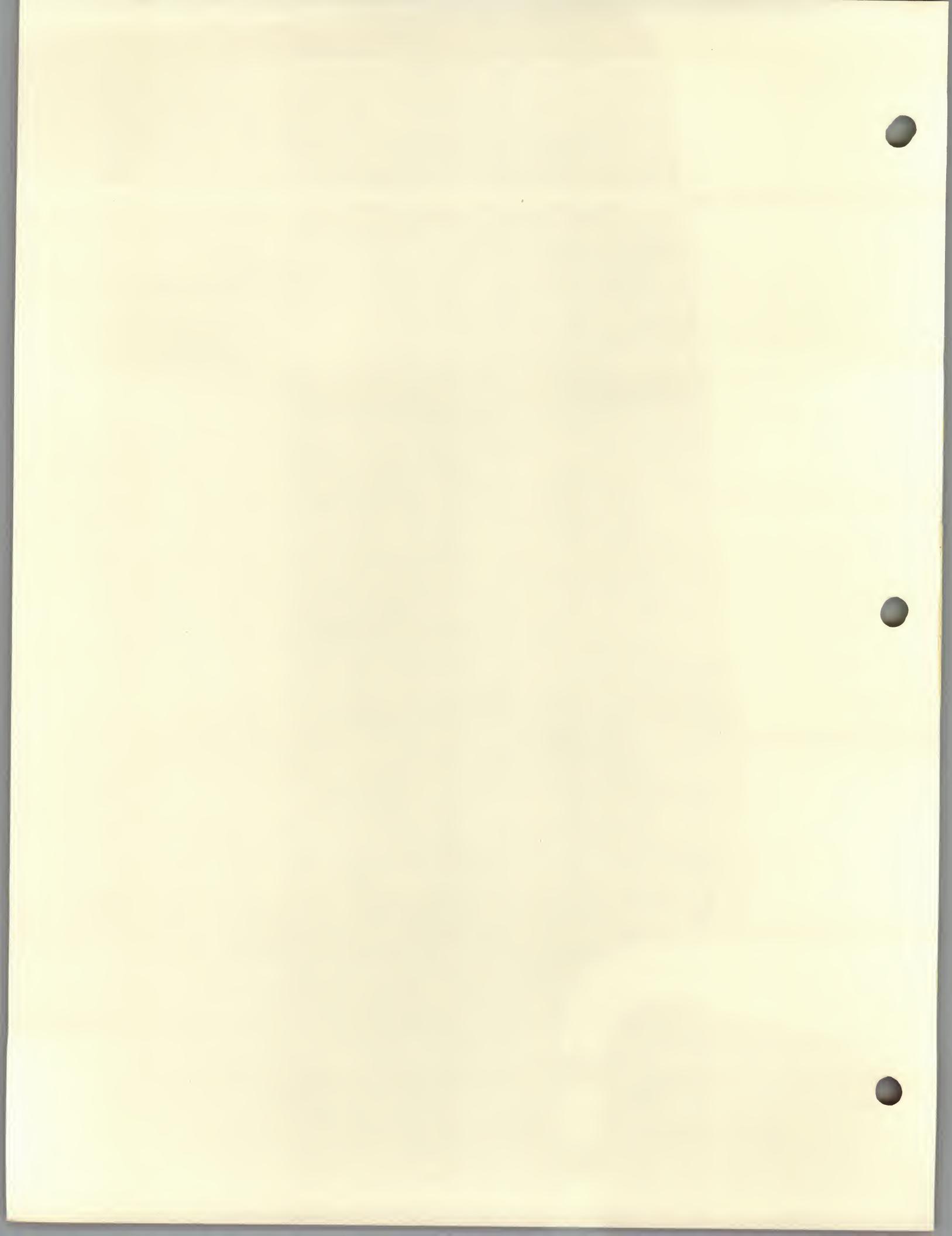
Table 3-4 Numeric Keypad Codes (Cont)

Key	ANSI Mode					VT52 Mode					
	Numeric Keypad Mode		Application Keypad Mode			Numeric Keypad Mode		Application Keypad Mode			
8	8		ESC	O	x	8		ESC	?	x	
	070		033	117	170	070		033	077	170	
9	9		ESC	O	y	9		ESC	?	y	
	071		033	117	171	071		033	077	171	
-	- (minus)		ESC	O	m	- (minus)*		ESC	?	m*	
	055		033	117	155	055		033	077	155	
,	, (comma)		ESC	O	I	, (comma)		ESC	?	I*	
	054		033	117	154	054		033	077	054	
.	. (period)		ESC	O	n	. (period)		ESC	?	n	
	056		033	117	156	056		033	077	156	
ENTER†	CR or CR	LF	ESC	O	M	CR or CR	LF	ESC	?	M	
	015	015	012	033	117	115	015	015	033	077	115
PF1	ESC	O	P	ESC	O	P	ESC	P	ESC	P	
	033	117	120	033	117	120	033	120	033	120	
PF2	ESC	O	Q	ESC	O	Q	ESC	Q	ESC	Q	
	033	117	121	033	117	121	033	121	033	121	
PF3	ESC	O	R	ESC	O	R	ESC	R	ESC	R	
	033	117	122	033	117	122	033	122	033	122	
PF4	ESC	O	S	ESC	O	S	ESC	S	ESC	S	
	033	117	123	033	117	123	033	123	033	123	

* These sequences are not generated by the VT52 terminal.

† When numeric keypad mode is selected (application keypad mode off), the **ENTER** character code can be changed by the linefeed/new line feature. When off, this feature causes **ENTER** to generate a single control character (CR, octal 015). When on, this feature causes **ENTER** to generate two characters (CR, octal 015 and LF, octal 012).

Received Character Processing



RECEIVED CHARACTER PROCESSING

4

GENERAL

This chapter describes how the terminal processes received characters. Characters received by the terminal can be either display characters or control functions. All display characters and control functions used by the terminal are described in this chapter.

RECEIVED CHARACTERS

The terminal processes characters in accordance with American National Standards Institute (ANSI) standards X3.64-1979, X3.4-1977, and X3.41-1974. ANSI standard X3.4 defines the American Standard Code for Information Interchange (ASCII) shown in Table 4-1. Table 4-1 shows each character with its binary, octal, decimal, and hexadecimal values. ASCII corresponds to the International Standards Organization (ISO) Standard 646 and International Telegraph and Telephone Consultive Committee (CCITT) Alphabet 5.

The terminal processes a received character based on the type of character as defined by ANSI. The position of the character in the ASCII table determines the type of character as either a control function or display character. The ASCII chart is 8 columns wide and 16 rows long. The control functions are in columns 0 and 1. The display characters are in columns 2 through 7. However, SPace is considered either an information separator control function or display character. DElete is always a control function.

Table 4-1 ASCII Table

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1		
		COLUMN 0		1		2		3		4		5		6		7		
B4	B3	B2	B1	ROW														
0	0	0	0	0	NUL	0	DLE	20	SP	40	0	60	@	100	P	120	^	140
0	0	0	1	1	SOH	1	DC1 (XON)	21	!	41	1	61	A	101	Q	121	a	141
0	0	1	0	2	STX	2	DC2	22	“	42	2	62	B	102	R	122	b	142
0	0	1	1	3	ETX	3	DC3 (XOFF)	23	#	43	3	63	C	103	S	123	c	143
1	1	0	0	4	EOT	4	DC4	24	\$	44	4	64	D	104	T	124	d	144
0	1	0	1	5	ENQ	5	NAK	25	%	45	5	65	E	105	U	125	e	145
0	1	1	0	6	ACK	6	SYN	26	&	46	6	66	F	106	V	126	f	146
0	1	1	1	7	BEL	7	ETB	27	/	47	7	67	G	107	W	127	g	147
1	0	0	0	8	BS	10	CAN	30	(	50	8	70	H	110	X	130	h	150
1	0	0	1	9	HT	11	EM	31	)	51	9	71	I	111	Y	131	i	151
1	0	1	0	10	LF	12	SUB	32	*	52	:	72	J	112	Z	132	j	152
1	0	1	1	11	VT	13	ESC	33	+	53	;	73	K	113	[	133	k	153
1	1	0	0	12	FF	14	FS	34	,	54	<	74	L	114	\	134	l	154
1	1	0	1	13	CR	15	GS	35	-	55	=	75	M	115	]	135	m	155
1	1	1	0	14	SO	16	RS	36	.	56	>	76	N	116	^	136	n	156
1	1	1	1	15	SI	17	US	37	/	57	?	77	O	117	—	137	o	157
						15		31		47		63		79		95		DEL
						F		1F		2F		3F		4F		5F		

KEY

ASCII CHARACTER	ESC	33 27 1B	OCTAL DECIMAL HEX
-----------------	-----	----------------	-------------------------

DISPLAY CHARACTERS

These characters are displayed on the screen. The actual character displayed depends on the character set selected in the terminal. The character set is selected using control functions. Refer to the Character Sets and Selection section of this chapter for more information about character sets.

CONTROL CHARACTERS

Control characters are single character control functions that start, modify, or stop terminal operations. The control functions are not displayed. Control characters recognized by the terminal are described in Table 4-2. All other control characters are ignored.

Control characters in this chapter are assigned a mnemonic. The mnemonic is an abbreviation of the control character name.

Table 4-2 Control Characters Recognized by VT101

Name	Mnemonic	Octal Code	Function
Null	NUL	000	Ignored when received (not stored in input buffer), used as a fill character
Enquire	ENQ	005	Transmits answerback message
Bell	BEL	007	Generates a bell tone
Backspace	BS	010	Moves cursor to the left one column position, unless it is at the left margin in which case no action occurs
Horizontal tab	HT	011	Moves cursor to the next tab stop, or to the right margin if there are no more tab stops
Linefeed	LF	012	Causes a linefeed or a new line operation (Refer to linefeed/new line mode)
Vertical tab	VT	013	Processed as linefeed
Form feed	FF	014	Processed as linefeed
Carriage return	CR	015	Moves cursor to left margin on the current line
Shift out	SO	016	Select G1 character set, as designated by a select character set sequence

Table 4-2 Control Characters Recognized by VT101 (Cont)

Name	Mnemonic	Octal Code	Function
Shift in	SI	017	Select GO character set, as designated by a select character set sequence
Device control 1	DC1	021	Processed as XON – causes terminal to continue transmitting characters
Device control 3	DC3	023	Processed as XOFF – causes terminal to stop transmitting all characters except XOFF and XON
Cancel	CAN	030	If received during an escape or control sequence, the sequence is cancelled and the substitution character () is displayed
			Characters of the sequence received after cancel character is displayed
Substitute	SUB	032	Processed as CAN
Escape	ESC	033	Processed as a sequence introducer

ESCAPE AND CONTROL SEQUENCES

These sequences provide controls not provided by the control characters in the character set. These sequences are multiple character control functions that are not displayed, but instead control terminal operation. Escape and control sequences are defined by ANSI X3.41-1977 and X3.64-1979. Refer to Appendix D for more information about sequences and sequence formats.

The terminal is an upward and downward software-compatible terminal. It can respond to control functions created to meet both private DIGITAL standards and present ANSI standards. Therefore, you can use existing software designed for previous terminals (such as the VT52) or new software designed for ANSI standards. However, future video terminals will not necessarily be compatible with the private DIGITAL sequences. Therefore, all new software should be designed using ANSI-compatible sequences.

The terminal uses VT52 mode to respond to private DIGITAL sequences. In VT52 mode, the terminal responds to private DIGITAL sequences as a VT52 terminal would respond.

The terminal uses ANSI mode to respond to a subset of control functions specified by ANSI. All control functions not presently specified by ANSI are created to comply with the extensions permitted by ANSI standards. These sequences are considered ANSI private sequences.

The ANSI-compatible control functions in this user guide have a mnemonic assigned by ANSI. If the control function is an ANSI private control function (a function defined by DIGITAL), the mnemonic begins with DEC. Characters in the escape and control sequences are shown using ASCII characters. The case (upper or lower) of the characters in the sequence is important and *must* be used as shown. The octal equivalent of each character in the sequence is given as a second reference. Refer to Table 4-1 for the decimal and hexadecimal representations of the characters.

Sequences described in this chapter are divided by software compatibility, ANSI or VT52 compatible, and are arranged by function (Table 4-3). Appendix C is a summary of all control functions.

Error Recovery

Present standards do not specify the action performed when a control function is received with an error. Errors are incorrect parameters, invalid control functions, or control characters embedded in control function sequences. The terminal generally recovers from these errors by performing as much of the function as possible. The following are the specific error recovery procedures of the terminal.

1. A control function not recognized by the terminal is generally ignored.
2. Control functions not supported by the terminal (valid control functions not listed in this user guide) are generally ignored but may not produce expected results.
3. If a control character is received within a sequence, the terminal performs the function of the control character, followed by the function of the sequence.
4. If CANcel (octal 030) or SUBstitute (octal 032) are received during a sequence, the current sequence is aborted. Also, the substitute character is displayed followed by characters in the sequence received after CAN or SUB.

Table 4-3 Escape and Control Sequence Arrangement

Sequence	Page
ANSI Compatible Sequences	
SET-UP Feature and Mode Selection	54
Set Mode (SM)	
Reset Mode (RM)	
ANSI/VT52 Compatibility	58
VT52 Mode (DECANM)	
Scrolling	59
Scroll Mode (DECSCLM)	
Scrolling Region	59
Set Top and Bottom Margins (DECSTBM)	
Origin	60
Origin Mode (DECOM)	
Cursor Positioning	61
Cursor Up (CUU)	
Cursor Down (CUD)	
Cursor Forward (CUF)	
Cursor Backward (CUB)	
Cursor Position (CUP)	
Cursor Position (Home) (CUP)	
Horizontal and Vertical Position (HVP)	
Horizontal and Vertical Position (Home) (HVP)	
Index (IND)	
Reverse Index (RI)	
Next Line (NEL)	
Save Cursor (DECSC)	
Restore Cursor (DECRC)	
Columns Per Line	64
Column Mode (DECCOLM)	
Auto Wrap	65
Auto Wrap Mode (DECAWM)	
Screen Background	66
Screen Mode (DECSCNM)	
Interlace	66
Interlace Mode (DECINLM)	
Linefeed/New Line	67
Linefeed/New Line Mode (LNM)	
Auto Repeat	68
Auto Repeat Mode (DECARM)	
Cursor Key Character Selection	68
Cursor Key Mode (DECCKM)	
Keypad Character Selection	69
Application Keypad (DECKPAM)	
Numeric Keypad (DECKPNM)	
Character Sets and Selection	71
Select Character Set (SCS)	
Single Shift 2 (SS2)	
Single Shift 3 (SS3)	
Character Attributes	76
Select Graphic Rendition (SGR)	

Table 4-3 Escape and Control Sequence Arrangement (Cont)

Sequence	Page
Tab Stops	77
Horizontal Tabulation Set (TDS)	
Tabulation Clear (TBC)	
Line Attributes	78
Double Height Line (DECIDL)	
Single Width Line (DECISW)	
Double Width Line (DECIDW)	
Erasing	79
Erase in Line (EL)	
Erase in Display (ED)	
Reports	80
Device Status Report (DSR)	
Cursor Position Report (CPR)	
Device Attributes (DA)	
Identify Terminal (DECID)	
Device Attributes (DA)	
Reset	82
Reset to Initial State (RIS)	
Tests	82
Invoke Confidence Test (DECTST)	
Adjustments	84
Screen Alignment Display (DECALN)	
Keyboard Indicators	84
Load LEDs (DECLL)	
 VT52 Compatible Sequences	
Modes	85
ANSI/VT52 Compatibility.....	86
ANSI Mode (DECANM)	
Cursor Positioning	86
Cursor Up	
Cursor Down	
Cursor Right	
Cursor Left	
Cursor to Home	
Direct Cursor Address	
Reverse Linefeed	
Keypad Character Selection	88
Enter Application Keypad Mode	
Exit Application Keypad Mode (Numeric Keypad Mode)	
Character Sets and Selection	90
Enter Graphics Mode	
Exit Graphics Mode	
Erasing	92
Erase to End of Line	
Erase to End of Screen	
Reports	92
Identify	

ANSI Compatible Sequences

ANSI compatible sequences meet ANSI standards X3.64-1979 and X3.41-1974. This section describes the ANSI control functions used by the terminal. ANSI compatibility is selected from the keyboard in SET-UP (refer to Chapter 2) or by the computer using a sequence. (Refer to the VT52 compatible sequences described in this chapter.)

SET-UP Feature and Mode Selection

SET-UP Feature and Mode Selection – SET-UP features change how the terminal operates. These features can be selected by the keyboard while in SET-UP. Some SET-UP features can also be selected by the computer using control functions. However, features selected by the computer are stored in operating memory. The computer cannot store feature selections into user memory. (Refer to Chapter 2 for more information about SET-UP feature memories.)

Some SET-UP features are modes. A mode is a feature of the terminal that affects operation. The mode selection is used until the computer or operator changes the selection. Table 4-4 lists the SET-UP features and modes. Modes are changed by the computer using the set mode (SM) and reset mode (RM) sequences. Use the following sequences to set and reset modes in the terminal.

*NOTE: Ps represents a variable parameter selected from a list of parameters. Asterisks (****) represent the parameter in the octal sequence. The parameter is transmitted using ASCII characters. When you set several modes with a single SM or RM sequence, a semicolon (;, octal 073) separates parameters.*

Set Mode (SM)

ESC	[	Ps	;	...	;	Ps	h
033	133	***	073	073	***	150	

The above sequence sets one or more modes as specified by each selective parameter (Ps) in the parameter string.

Reset Mode (RM)

ESC	[	Ps	;	...	;	Ps	I
033	133	***	073	073	***	154	

The above sequence resets one or more modes as specified by each selective parameter (Ps) in the parameter string.

Table 4-4 SET-UP Features and Modes

Feature/Mode	Changed from Computer	Changed from Keyboard in SET-UP
ON/OFF line	No	Yes
Screen brightness	No	Yes
Columns per line	Yes (DECCOLM)	Yes
Tab stops	Yes (HTS/TBC)*	Yes
Scroll	Yes (DECSCLM)	Yes
Auto repeat	Yes (DECARM)	Yes
Screen background	Yes (DECSCNM)	Yes
Cursor	No	Yes
Margin bell	No	Yes
Keyclick	No	Yes
ANSI/VT52	Yes (DECANM)	Yes
Auto XON/XOFF	No	Yes
US/UK character set	Yes (SCS)*	Yes
Auto wrap	Yes (DECAWM)	Yes
Linefeed/new line	Yes (LNM)	Yes
Interlace	Yes (DECINLM)	Yes
Receive parity	No	Yes
Local echo	No	Yes
Power	No	Yes
Data/parity bits	No	Yes
Transmit speed	No	Yes
Receive speed	No	Yes
Application keypad mode	Yes (DECKPAM/DECKPNM)*	No
Cursor key mode	Yes (DECCKM)	No
Origin mode	Yes (DECOM)	No

* These features are not changed using set mode (SM) and reset mode (RM) sequences.

Table 4-5 lists the ANSI specified modes and their selective parameters (Ps). Table 4-6 lists the ANSI compatible private modes and their selective parameters. When changing ANSI compatible private modes, the first character in the parameter string is a question mark (octal 077). All parameters in the sequence are interpreted as ANSI compatible private parameters. Each mode is explained in detail later in this chapter. The sequence to set and reset each mode is also given.

The following example shows the use of the question mark (used with ANSI private parameters) and semicolon (used with multiple parameters). The sequence sets both column and scroll modes.

ESC	[	?	3	;	4	h
033	133	077	063	073	064	150

The modes in Table 4-7 are specified in ANSI X3.64-1979 and are permanently set, permanently reset, or not applicable. Refer to the ANSI standard for more information about these modes.

Table 4-5 ANSI Specified Modes

Mode	Mnemonic	Parameter (Ps)
Error (ignored)	-	0
Linefeed/new line	LNM	20

Table 4-6 ANSI Compatible Private Modes

Mode	Mnemonic	Parameter (Ps)
Error (ignored)	-	0
Cursor key	DECCKM	1
ANSI/VT52	DECANM	2
Column	DECCOLM	3
Scroll	DECSCLM	4
Screen	DECSCNM	5
Origin	DECOM	6
Auto wrap	DECAWM	7
Auto repeat	DECARM	8
Interlace	DECINLM	9

NOTE: The application keypad and numeric keypad modes are selected using dedicated sequences. The set and reset mode sequences are not used to select these modes. Refer to the description of keypad character selection in this chapter for more information about these sequences.

Table 4-7 Permanently Selected Modes

Mode	Mnemonic	Selection	Function
Control representation	CRM	Reset	Control functions are performed without displaying a character to represent the control function received.
Editing boundary	EBM	Reset	Characters moved outside the margins are lost, and the erasing and cursor positioning functions are not performed outside the margins. This does not affect the horizontal and vertical position (HVP) and cursor position (CUP) sequences.
Erasure	ERM	Set	All characters displayed can be erased.
Format effector action	FEAM	Reset	Control functions that affect the screen display are performed immediately.
Format effector transfer	FETM	N/A	
Guarded area transfer	GATM	N/A	
Horizontal editing	HEM	N/A	
Insertion-replacement	IRM	Reset	Received characters replace characters at the cursor position.
Keyboard action	KAM	Reset	Typed characters are processed except during the keyboard locked condition.
Multiple area transfer	MATM	N/A	
Positioning unit	PUM	Reset	Horizontal and vertical positioning parameters in control functions are specified in units of character position.

Table 4-7 Permanently Selected Modes (Cont)

Mode	Mnemonic	Selection	Function
Selected area transfer	SATM	N/A	
Status reporting transfer	SRTM	Reset	Status reports are transmitted by the VT101 using the device status report (DSR) sequence.
Tabulation stop	TSM	Reset	Tab stop selections apply to the corresponding column of all lines on the screen.
Transfer termination	TTM	N/A	
Vertical editing	VEM	N/A	

ANSI/VT52 Compatibility

ANSI/VT52 Compatibility – The terminal is compatible with both ANSI and private DIGITAL standards. Therefore, new software that meets the ANSI standards and existing software designed for previous terminals (such as the VT52) can be used.

ANSI compatible sequences meet ANSI standards X3.64-1979 and X3.41-1974. ANSI compatibility is selected in the terminal using the ANSI/VT52 mode (DECANM) sequence in VT52 mode. Refer to the VT52 compatible sequence section in this chapter for details on selecting ANSI sequence compatibility. When the terminal is in ANSI mode, the following sequence selects compatibility with private DIGITAL sequences (VT52 mode).

VT52 Mode (DECANM)

ESC	[	?	2	I
033	133	077	062	154

Reset selects private DIGITAL sequence compatibility while in ANSI mode. In VT52 mode, terminal responds to sequences like a VT52. Features and modes selected in ANSI mode are also used in VT52 mode. However, these features and modes usually cannot be changed while in VT52 mode.

Scrolling

Scrolling – Scrolling is the upward or downward movement of existing lines on the screen. It makes room for more lines of characters at either the top or bottom of the scrolling region. Scrolling is performed in two ways: jump scroll, or smooth scroll. Use the following sequences to select the type of scrolling.

NOTE: The auto XON/XOFF feature prevents the loss of received characters when using smooth scroll. If auto XON/XOFF is not used, fill characters are needed.

Scroll Mode (DECSCLM)

ESC	[	?	4	h
033	133	077	064	150

The above set sequence selects smooth scrolling. Smooth scrolling allows lines to be added to the screen at 6 lines per second (power feature=60 Hz), 5 lines per second (power feature=50 Hz).

ESC	[	?	4	I
033	133	077	064	154

The above reset sequence selects jump scrolling. Jump scrolling allows lines to be added to the screen as fast as possible.

Scrolling Region

Scrolling Region – The scrolling region is the area of the screen between the top and bottom margins. The margins determine which lines on the screen are moved during scrolling. Characters added to the screen outside the scrolling region do not cause the screen to scroll. The minimum size of the scrolling region is two lines. Therefore, the line number of the top margin must be less than the line number of the bottom margin. Line numbers are determined by the origin mode feature.

When the margins are selected, the cursor moves to the home position. The home position is determined by the origin mode feature. Use the following sequence to select the top and bottom margins of the scrolling region.

NOTES

1. When you power up or use the reset command, the scrolling region becomes the full screen.
2. Pt and Pb represent variable numeric parameters. The parameters are decimal numbers transmitted to the terminal as ASCII characters. Asterisks (***) represent one or more variable numeric parameters in the octal sequence.

Set Top and Bottom Margins (DECSTBM)

ESC	[	Pt	;	Pb	r
033	133	***	073	***	162

The above sequence selects top and bottom margins, defining the scrolling region. Pt is line number of the first line in the scrolling region. Pb is line number of the bottom line in the scrolling region. If Pt and Pb are not selected, the complete screen is used (no margins).

Origin

Origin – This mode determines if the cursor can move outside the scrolling region (the area between the top and bottom margins). The cursor is moved outside the margins with the cursor position (CUP) and horizontal and vertical position (HVP) sequences.

Lines on the screen are numbered. Numbering is determined by the location of the home position. Home position is always line 1, column 1. The cursor moves to the new home position whenever origin mode is selected. Use the following sequences to select origin mode.

NOTE: Power-up or reset causes origin mode to be reset.

Origin Mode (DECOM)

ESC	[	?	6	h
033	133	077	066	150

The above set sequence selects home position in the scrolling region. Line numbers are relative to top margin of the scrolling region. Cursor cannot move out of the scrolling region.

ESC	[	? 6 I
033	133	077 066 154

The above reset sequence selects home position in the upper-left corner of the screen. Line numbers are independent of the scrolling region (absolute). Cursor can move out of the scrolling region using the CUP and HVP sequences.

Cursor Positioning

Cursor Positioning – The cursor indicates the location of the active position. This is where the next character is displayed. The cursor position moves:

- One column to the right when a character is displayed.
- One line down when a linefeed (LF, octal 012), form feed (FF, octal 014) or vertical tab (VT, octal 013) is received. (Linefeed/new line may cause the cursor to also move to the left margin.)
- To the left margin when a carriage return (CR, octal 015) is received.
- One column to the left when a backspace (BS, octal 010) is received.
- To the next tab stop or right margin if no tabs are set and a horizontal tab character (HT, octal 011) is received.
- To the home position when the top and bottom margins of the scrolling region DECSTBM) or origin mode (DECOM) selection is changed.

The cursor is also moved using the following sequences.

*NOTE: Pn represents a variable numeric parameter. This parameter is a decimal number transmitted to the terminal using ASCII characters. If no parameter or a parameter of 0 is selected, the terminal assumes the parameter equals 1. Asterisks (*** represent a variable parameter within the octal sequence.*

Cursor Up (CUU)

ESC	[Pn A
033	133 *** 101

The above sequence moves cursor up Pn lines in the same column. Cursor stops at the top margin.

Cursor Down (CUD)

ESC [Pn B
033 133 *** 102

The above sequence moves cursor down Pn lines in the same column. Cursor stops at the bottom margin.

Cursor Forward (CUF)

ESC [Pn C
033 133 *** 103

The above sequence moves cursor right Pn columns. Cursor stops at the right margin.

Cursor Backward (CUB)

ESC [Pn D
033 133 *** 104

The above sequence moves cursor left Pn columns. Cursor stops at the left margin.

*NOTE: PI and Pc represent variable numeric parameters. The parameter is a decimal number that represents one or more characters transmitted to the terminal as ASCII characters. Asterisks (***) represent a variable parameter in the octal sequence.*

Cursor Position (CUP)

ESC [PI ; Pc H
033 133 *** 073 *** 110

The above sequence moves cursor to line PI, column Pc. If either PI or Pc are not selected or selected as 0, the cursor moves to first line or column, respectively. Numbering of lines and ability to move the cursor into margins depends on origin mode (DECOM).

NOTE: CUP operates the same as the horizontal and vertical position (HVP) sequence.

Cursor Position (Home) (CUP)

ESC [H
033 133 110

The above sequence moves cursor to home position. Home position depends on origin mode (DECOM).

Horizontal and Vertical Position (HVP)

ESC [PI ; Pc f
033 133 *** 073 *** 146

The above sequence moves cursor to line PI, column Pc. If either PI or Pc are not selected or selected as 0, the cursor moves to first line or column, respectively. Numbering of lines and ability to move the cursor into margins depends on origin mode (DECOM).

NOTE: HVP operates the same as the cursor position (CUP) sequence.

Horizontal and Vertical Position (Home) (HVP)

ESC [f
033 133 146

The above sequence moves cursor to home position. Home position depends on origin mode (DECOM).

Index (IND)

ESC D
033 104

The above sequence moves cursor down one line in the same column. If the cursor is at the bottom margin, a scroll up is performed.

Reverse Index (RI)

ESC M
033 115

The above sequence moves cursor up one line in the same column. If the cursor is at the top margin, a scroll down is performed.

Next Line (NEL)

ESC E
033 105

The above sequence moves cursor to first position on the next line. If the cursor is at the bottom margin, a scroll up is performed.

Save Cursor (DECSC)

ESC 7
033 067

The above sequence saves cursor position, character attribute (graphic rendition), character set and origin mode selection. (Refer to restore cursor.)

Restore Cursor (DECRC)

ESC 8
033 070

The above sequence restores the previously saved cursor position, character attribute (graphic rendition), character set and origin mode selection. If none were saved, the cursor moves to home position.

Columns per Line

Columns per Line – Column mode selects the number of columns in a display line to be either 80 or 132. With 80 columns per line selected, the screen can display 24 lines of characters with 80 columns per line. With 132 columns per line selected, the screen can display 14 lines of characters with 132 columns per line. Use the following sequences to select the number of columns per line.

NOTE: When switching between 80 and 132 columns per line, the screen is erased. Also, the scrolling region is selected for full screen (24 lines).

Column Mode (DECCOLM)

ESC [? 3 h
033 133 077 063 150

The above set sequence selects 132 columns per line (14 display lines).

ESC [? 3 I
033 133 077 063 154

The above reset sequence selects 80 columns per line (24 display lines).

Auto Wrap

Auto Wrap – Auto wrap mode selects where a received character is placed when the cursor is at the right margin. Use the following sequences to select auto wrap.

NOTE: Regardless of the auto wrap feature selection, the tab character never moves the cursor to the next line.

Auto Wrap Mode (DECAWM)

ESC [? 7 h
033 133 077 067 150

The above set sequence selects auto wrap. Any display characters received when the cursor is at the right margin are displayed on the next line. The display scrolls up if the cursor is at the end of the scrolling region.

ESC [? 7 I
033 133 077 067 154

The above reset sequence turns auto wrap off. Display characters received when the cursor is at the right margin replace the previously displayed character.

Screen Background

Screen Background – Screen mode selects either light or dark display background on the screen. Use the following sequences to select screen background.

Screen Mode (DECSCNM)

ESC [? 5 h
033 133 077 065 150

The above set sequence selects reverse screen (a white screen background with black characters).

ESC [? 5 I
033 133 077 065 154

The above reset sequence selects normal screen (a black screen background with white characters).

Interlace

Interlace – Interlace mode selects the number of scan lines used to create characters on the screen. The terminal can use either 240 or 480 scan lines per screen. This feature does not add any new information to the screen. But it may improve images created by hardcopy or video devices connected to the video output connector. Usually operators prefer interlace selected for 240 scans per screen. Use the following sequences to select the number of scan lines per screen.

Interlace Mode (DECINLM)

ESC [? 9 h
033 133 077 071 150

The above set sequence selects 480 scan lines per screen.

ESC [? 9 I
033 133 077 071 154

The above reset sequence selects 240 scan lines per screen.

Linefeed/New Line

Linefeed/New Line – Linefeed/new line mode selects the control character(s) transmitted by the **RETURN** key. Also, this feature determines the action taken by the terminal when receiving linefeed, form feed, and vertical tab. Table 4-8 provides a summary of the feature. Use the following sequences to select linefeed/new line.

Linefeed/New Line Mode (LNM)

ESC [2 0 h
033 133 062 060 150

The above set sequence causes a received linefeed, form feed, or vertical tab to move the cursor to the first column of the next line. **RETURN** transmits both a carriage return and linefeed. This selection is also called new line option.

ESC [2 0 I
033 133 062 060 154

The above reset sequence causes a received linefeed, form feed or vertical tab to move the cursor to the next line in the current column. **RETURN** transmits a carriage return.

Table 4-8 Linefeed/New Line Feature

Selection	Key Pressed – Character Sent	Character Received – Function
Off	RETURN – CR	CR – Cursor moves to left margin
Off	LINE FEED – LF	LF – Cursor moves to the next line but stays in same column
On	RETURN – CR LF	CR – Cursor moves to left margin
On	LINE FEED – LF	LF – Cursor moves to left margin of next line

Auto Repeat

Auto Repeat – Auto repeat mode selects automatic key repeating. Automatic key repeating causes a key pressed for more than one-half second to automatically repeat the transmission of the character. Key repeating does not affect the **SET-UP**, **ESC**, **RETURN**, **ENTER**, **NO SCROLL**, and **CTRL** keys. Use the following sequences to select auto repeat mode.

Auto Repeat Mode (DECARM)

ESC	[	?	8	h
033	133	077	070	150

The above set sequence selects auto repeat. A key pressed for more than one-half second automatically repeats.

ESC	[	?	8	l
033	133	077	070	154

The above reset sequence turns off auto repeat. Keys do not automatically repeat.

Cursor Key Character Selection

Cursor Key Character Selection – Cursor key mode selects the set of characters transmitted by the cursor keys. The cursor control keys can generate either application control functions or ANSI specified cursor control sequences. Refer to Table 4-9 for the characters transmitted by the cursor keys. Use the following sequences to select cursor key mode.

NOTE: Power-up or reset causes cursor key mode to be reset.

Cursor Key Mode (DECCKM)

ESC	[	?	1	h
033	133	077	061	150

The above set sequence causes cursor keys to generate application control functions.

ESC	[	?	1	l
033	133	077	061	154

The above reset sequence causes cursor keys to generate ANSI cursor control sequences.

Table 4-9 ANSI Cursor Control Key Codes

Cursor	Cursor Key Mode Reset (Cursor Control)			Cursor Key Mode Set (Application)		
↑	ESC	[	A	ESC	O	A
	033	133	101	033	117	101
↓	ESC	[	B	ESC	O	B
	033	133	102	033	117	102
→	ESC	[	C	ESC	O	C
	033	133	103	033	117	103
←	ESC	[	D	ESC	O	D
	033	133	104	033	117	104

Keypad Character Selection

Keypad Character Selection – The numeric keypad can generate either numeric characters or control functions. When it is used for numeric character entry, numeric keypad mode is selected. Refer to Table 4-10 for the characters generated by these keys. Use the following sequences to select the characters generated by the numeric keypad keys.

NOTE: Power-up or reset causes numeric keypad mode to be selected.

Application Keypad (DECKPAM)

ESC =
033 075

The above sequence selects alternate (application) keypad mode when the numeric keypad is used for control function entry.

Numeric Keypad (DECKPNM)

ESC >
033 076

The above sequence selects numeric keypad mode. The keys generate characters that correspond to the numeric, comma, period, and minus sign keys on the main keyboard.

Table 4-10 ANSI Numeric Keypad Codes

Key	Numeric Keypad Mode	Application Keypad Mode
0	0 060	ESC O p 033 117 160
1	1 061	ESC O q 033 117 161
2	2 062	ESC O r 033 117 162
3	3 063	ESC O s 033 117 163
4	4 064	ESC O t 033 117 164
5	5 065	ESC O u 033 117 165
6	6 066	ESC O v 033 117 166
7	7 067	ESC O w 033 117 167
8	8 070	ESC O x 033 117 170
9	9 071	ESC O y 033 117 171
-(minus)	-(minus) 055	ESC O m 033 117 155
,(comma)	,(comma) 054	ESC O i 033 117 154
.(period)	.(period) 056	ESC O n 033 117 156

Table 4-10 ANSI Numeric Keypad Codes (Cont)

Key	Numeric Keypad Mode			Application Keypad Mode		
ENTER*	CR	CR	LF	ESC	O	M
	015 or 015	012		033	117	115
PF1	ESC	O	P	ESC	O	P
	033	117	120	033	117	120
PF2	ESC	O	Q	ESC	O	Q
	033	117	121	033	117	121
PF3	ESC	O	R	ESC	O	R
	033	117	122	033	117	122
PF4	ESC	O	S	ESC	O	S
	033	117	123	033	117	123

NOTE: In ANSI mode, if the codes are echoed back to the terminal, or if the terminal is off-line, the last character of the sequence is displayed on the screen. For example, PF4 is displayed as an "S".

* When numeric keypad mode is selected, **ENTER** generates the same characters as **RETURN**. The **RETURN** character code can be changed by the linefeed/new line feature. When off, this feature causes the key to generate a single control character (CR, octal 015). When on, this feature causes the key to generate two characters (CR, octal 015 and LF, octal 012).

Character Sets and Selection

Character Sets and Selection – The terminal can display up to 126 different characters. However, it can select from only 94 characters (one character set) at a time. Therefore, display characters are held in three character sets, with some characters appearing in more than one set. The terminal uses the United States, United Kingdom, and special characters and line drawing character sets.

Tables 4-11 through 4-13 show the character sets. The US and UK character sets meet the "ISO international register of character sets to be used with escape sequences." Notice the control characters and SPace character are the same in all character sets.

Any two character sets are considered active at any one time. The two active character sets are designated by the computer as G0 and G1 using the select character set (SCS) sequence. Once the character sets are designated, a single control character switches between the character sets. Shift In (SI, octal 017) invokes the G0 character set. Shift Out (SO, octal 016) invokes the G1 character set.

Table 4-11 United Kingdom Character Set

BITS		0 0 0			0 0 1			0 1 0			0 1 1			1 0 0			1 0 1			1 1 0			1 1 1		
		COLUMN			0		1		2		3		4		5		6		7						
B4	B3	B2	B1	ROW	NUL	0	0	20	SP	40	0	60	@	100	P	120	‘	140	p	160	112	70			
0	0	0	0	0	1	1	1	10	21	41	1	61	A	101	Q	121	a	141	q	161	113	71			
0	0	0	1	1	1	1	1	11	17	33	1	49	A	101	Q	121	a	141	q	161	113	71			
0	0	1	0	2	2	2	2	12	22	42	2	62	B	102	R	122	b	142	r	162	114	72			
0	0	1	1	3	3	3	3	13	23	43	3	63	C	103	S	123	c	143	s	163	115	73			
0	1	0	0	4	4	4	4	14	24	44	4	64	D	104	T	124	d	144	t	164	116	74			
0	1	0	1	5	ENQ	5	5	15	25	45	5	65	E	105	U	125	e	145	u	165	117	75			
0	1	1	0	6		6	6	16	26	46	6	66	F	106	V	126	f	146	v	166	118	76			
0	1	1	1	7	BEL	7	7	17	27	47	7	67	G	107	W	127	g	147	w	167	119	77			
1	0	0	0	8	BS	10	8	8	CAN	30	(	50	8	H	110	X	130	h	150	x	170	120	78	
1	0	0	1	9	HT	11	9	9		31	)	51	9	I	111	Y	131	i	151	y	171	121	79	
1	0	1	0	10	LF	12	10	A	SUB	32	*	52	:	J	112	Z	132	j	152	z	172	122	7A		
1	0	1	1	11	VT	13	11	B	ESC	33	+	53	;	K	113	[	133	k	153	{	173	123	7B	
1	1	0	0	12	FF	14	12	C		34	,	54	<	L	114	\	134	l	154	|	174	124	7C		
1	1	0	1	13	CR	15	13	D		35	-	55	=	M	115	]	135	m	155	}	175	125	7D	
1	1	1	0	14	SO	16	14	E		36	.	56	>	N	116	^	136	n	156	~	176	126	7E		
1	1	1	1	15	SI	17	15	F		37	/	57	?	O	117	-	137	o	157		177	127	7F		

KEY

ASCII CHARACTER	ESC	33	OCTAL
		27	DECIMAL
		1B	HEX

Table 4-12 United States Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
		COLUMN 0		1		2		3		4		5		6		7	
B4	B3	B2	B1	ROW													
0	0	0	0	0	NUL	0		20		SP	40	0	60	@	100	P	120
0	0	0	1	1	DC1 (XON)	21	!	41	1	61	49	A	101	Q	121	a	141
0	0	1	0	2		22	"	42	2	62	50	B	102	R	122	b	142
0	0	1	1	3	DC3 (XOFF)	23	#	43	3	63	51	C	103	S	123	c	143
0	1	0	0	4		24	\$	44	4	64	52	D	104	T	124	d	144
0	1	0	1	5	ENQ	25	%	45	5	65	53	E	105	U	125	e	145
0	1	1	0	6		26	&	46	6	66	54	F	106	V	126	f	146
0	1	1	1	7	BEL	27	/	47	7	67	55	G	107	W	127	g	147
1	0	0	0	8	BS	28	(	48	8	70	56	H	110	X	130	h	150
1	0	0	1	9	HT	29	)	49	9	71	57	I	111	Y	131	i	151
1	0	1	0	10	LF	30	*	50	10	72	58	J	112	Z	132	j	152
1	0	1	1	11	VT	31	+	51	11	73	59	K	113	[	133	k	153
1	1	0	0	12	FF	32	,	52	12	74	60	L	114	\	134	l	154
1	1	0	1	13	CR	33	-	53	13	75	61	M	115	]	135	m	155
1	1	1	0	14	SO	34	.	54	14	76	62	N	116	^	136	n	156
1	1	1	1	15	SI	35	/	55	15	77	63	O	117	-	137	o	157
						36	56	56		78	64						177
						37	57	57		79	65						178
						38	58	58		80	66						179
						39	59	59		81	67						180
						40	60	60		82	68						181
						41	61	61		83	69						182
						42	62	62		84	70						183
						43	63	63		85	71						184
						44	64	64		86	72						185
						45	65	65		87	73						186
						46	66	66		88	74						187
						47	67	67		89	75						188
						48	68	68		90	76						189
						49	69	69		91	77						190
						50	70	70		92	78						191
						51	71	71		93	79						192
						52	72	72		94	80						193
						53	73	73		95	81						194
						54	74	74		96	82						195
						55	75	75		97	83						196
						56	76	76		98	84						197
						57	77	77		99	85						198
						58	78	78		100	86						199
						59	79	79		101	87						200
						60	80	80		102	88						201
						61	81	81		103	89						202
						62	82	82		104	90						203
						63	83	83		105	91						204
						64	84	84		106	92						205
						65	85	85		107	93						206
						66	86	86		108	94						207
						67	87	87		109	95						208
						68	88	88		110	96						209
						69	89	89		111	97						210
						70	90	90		112	98						211
						71	91	91		113	99						212
						72	92	92		114	100						213
						73	93	93		115	101						214
						74	94	94		116	102						215
						75	95	95		117	103						216
						76	96	96		118	104						217
						77	97	97		119	105						218
						78	98	98		120	106						219
						79	99	99		121	107						220
						80	100	100		122	108						221
						81	101	101		123	109						222
						82	102	102		124	110						223
						83	103	103		125	111						224
						84	104	104		126	112						225
						85	105	105		127	113						226
						86	106	106		128	114						227
						87	107	107		129	115						228
						88	108	108		130	116						229
						89	109	109		131	117						230
						90	110	110		132	118						231
						91	111	111		133	119						232
						92	112	112		134	120						233
						93	113	113		135	121						234
						94	114	114		136	122						235
						95	115	115		137	123						236
						96	116	116		138	124						237
						97	117	117		139	125						238
						98	118	118		140	126						239
						99	119	119		141	127						240
						100	120	120		142	128						241
						101	121	121		143	129						242
						102	122	122		144	130						243
						103	123	123		145	131						244
						104	124	124		146	132						245
						105	125	125		147	133						246
						106	126	126		148	134						247
						107	127	127		149	135						248
						108	128	128		150	136						249
						109	129	129		151	137						250
						110	130	130		152	138						251
						111	131	131		153	139						252
						112	132	132		154	140						253
						113	133	133		155	141						254
						114	134	134		156	142						255
						115	135	135		157	143						256
						116	136	136		158	144						257
						117	137	137		159	145		</td				

Table 4-13 Special Characters and Line Drawing Character Set

BITS			0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1														
B7	B6	B5	COLUMN			0			1			2			3			4			5			6			7				
B4	B3	B2	B1	ROW																											
0	0	0	0	0	NUL	0	0	0	20	16	10	SP	40	32	20	0	60	48	30	@	100	64	40	P	120	80	50	◆	140	—	160
0	0	0	1	1	DC1 (XON)	1	1	1	21	17	11	!	41	33	21	1	61	49	31	A	101	65	41	Q	121	81	51	■	141	—	161
0	0	1	0	2		2	2	2	22	18	12	“	42	34	22	2	62	50	32	B	102	66	42	R	122	82	52	■	142	—	162
0	0	1	1	3		3	3	3	23	19	13	#	43	35	23	3	63	51	33	C	103	67	43	S	123	83	53	■	143	—	163
0	1	0	0	4		4	4	4	24	20	14	\$	44	36	24	4	64	52	34	D	104	68	44	T	124	84	54	■	144	—	164
0	1	0	1	5	ENQ	5	5	5	25	21	15	%	45	37	25	5	65	53	35	E	105	69	45	U	125	85	55	■	145	—	165
0	1	1	0	6		6	6	6	26	22	16	&	46	38	26	6	66	54	36	F	106	70	46	V	126	86	56	■	146	—	166
0	1	1	1	7	BEL	7	7	7	27	23	17	,	47	39	27	7	67	55	37	G	107	71	47	W	127	87	57	■	147	—	167
1	0	0	0	8	BS	10	8	8	CAN	30	24	(	50	40	28	8	70	56	38	H	110	72	48	X	130	88	58	■	148	—	168
1	0	0	1	9	HT	11	9	9		31	25	)	51	41	29	9	71	57	39	I	111	73	49	Y	131	89	59	■	149	—	169
1	0	1	0	10	LF	12	10	A	SUB	32	26	*	52	42	2A	:	72	58	3A	J	112	74	4A	Z	132	90	5A	■	150	—	170
1	0	1	1	11	VT	13	11	B	ESC	33	27	+	53	43	2B	;	73	59	3B	K	113	75	4B	L	133	91	5B	■	151	—	171
1	1	0	0	12	FF	14	12	C		34	28	,	54	44	2C	<	74	60	3C	L	114	76	4C	\	134	92	5C	■	152	—	172
1	1	0	1	13	CR	15	13	D		35	29	-	55	45	2D	=	75	61	3D	M	115	77	4D	J	135	93	5D	■	153	—	173
1	1	1	0	14	SO	16	14	E		36	30	.	56	46	2E	>	76	62	3E	N	116	78	4E	A	136	94	5E	■	154	—	174
1	1	1	1	15	SI	17	15	F		37	31	/	57	47	2F	?	77	63	3F	O	117	79	4F	(BLANK)	137	95	5F	■	155	—	175
																											SCAN 1				

KEY

ASCII CHARACTER	ESC	33	OCTAL
		27	DECIMAL
		1B	HEX

The designated character sets are active until another SCS sequence is received. The G0 and G1 character sets can be designated as often as needed using the SCS sequence. The following sequences designate the G0 character set.

Select Character Set (SCS)

ESC (A
033 050 101

The above sequence designates the United Kingdom character set as G0.

ESC (B
033 050 102

The above sequence designates the United States character set as G0.

ESC (0
033 050 060

The above sequence designates the special character and line drawing character set as G0.

The following sequences designate the G1 character set.

Select Character Set (SCS)

ESC) A
033 051 101

The above sequence designates the United Kingdom character set as G1.

ESC) B
033 051 102

The above sequence designates the United States character set as G1.

ESC) 0
033 051 060

The above sequence designates the special character and line drawing character set as G1.

The terminal also has G2 and G3 character sets. However, these are always the default (selected in SET-UP) character set. The terminal returns to the previously selected character set after a single character is displayed. Use the following sequences to select G2 and G3.

Single Shift 2 (SS2)

ESC N
033 115

The above sequence selects the G2 (default) character set for one character. The default character set is selected in SET-UP.

Single Shift 3 (SS3)

ESC O
033 117

The above sequence selects the G3 (default) character set for one character. The default character set is selected in SET-UP.

Character Attributes

Character Attributes – A character attribute changes the character display without changing the character. A displayed character can only have one attribute. The character attribute of the terminal is either underline or reverse (negative) video. Reverse video displays the character using a screen background opposite of the screen background feature. The terminal uses the attribute selected for the cursor by the cursor SET-UP feature.

After the character attribute is selected, all characters received by the terminal are displayed with the attribute, until the attribute selection is changed. Use the following sequences to select the character attribute.

Select Graphic Rendition (SGR)

ESC [m or ESC [0 m
033 133 155 033 133 060 155

Either of the above sequences turns off character attribute.

ESC [4 m or **ESC [7 m**
033 133 064 155 033 133 067 155

Either of the above sequences selects character attribute (either underline or reverse video).

Tab Stops

Tab Stops – Tab stops are positions selected on the horizontal lines of the screen. The cursor advances (tabs) to the next tab stop when the terminal receives a horizontal tab (HT, octal 011). If no tab stops are set, horizontal tab moves the cursor to the right margin. Use the following sequences to set and clear tab stops.

Horizontal Tabulation Set (HTS)

ESC H
033 110

The above sequence sets a horizontal tab stop at the cursor position.

Tabulation Clear (TBC)

ESC [g or **ESC [0 g**
033 133 147 033 133 060 147

The above sequence clears a horizontal tab stop at the cursor position.

ESC [3 g
033 133 063 147

The above sequence clears all horizontal tab stops.

Line Attributes

Line Attributes – Line attributes are display features that affect a complete display line. The cursor selects the line affected by the attribute. The cursor stays in the same character position when the line attribute is changed. However, if the cursor would be moved past the right margin, it stops at the right margin. When lines are moved on the screen (by scrolling), the line attribute moves with the line. Use the following sequences to select line attributes.

NOTE: If an entire line is erased using the erase in display (ED) sequence, the line attribute is changed to single-height, single-width.

Double Height Line (DECDHL)

Top half:	Bottom half:
ESC # 3 033 043 063	ESC # 4 033 043 064

The above sequences cause the line with the cursor to become top or bottom half of a double-height double-width line. Sequences are used in pairs on adjacent lines. The same character must be displayed on both lines to form full characters. If the line is single-width single-height, all characters to the right of the center of the screen are lost.

Single Width Line (DECSWL)

ESC # 5
033 043 065

The above sequence causes the line with the cursor to become single-width single-height. This is the line attribute for all new lines on the screen.

Double Width Line (DECDWL)

ESC # 6
033 043 066

The above sequence causes the line with the cursor to become double-width and single-height. If the line is single-width and single-height, all characters to the right of the center of the screen are lost.

Erasing

Erasing – Erasing removes characters from the screen without affecting other characters on the screen. When characters are erased, they are lost. When erasing a complete line using the erase in display (ED) sequence, the line attribute becomes single-height single-width. If a line is erased using the erase in line (EL) sequence, the line attribute is not affected. When a character is erased, any character attribute of the character is also erased. The cursor position is not changed when erasing characters or lines. Use the following sequences to erase characters.

Erase In Line (EL)

ESC [K or **ESC** [0 K
033 133 113 033 133 060 113

Either of the above sequences erases from cursor to the end of the line, including the cursor position.

ESC [1 K
033 133 061 113

The above sequence erases from beginning of the line to the cursor, including the cursor position.

ESC [2 K
033 133 062 113

The above sequence erases all of the line.

Erase In Display (ED)

ESC [J or **ESC** [0 J
033 133 112 033 133 060 112

Either of the above sequences erases from cursor to the end of the screen, including the cursor position.

ESC [1 J
033 133 061 112

The above sequence erases from beginning of the screen to the cursor, including the cursor position.

ESC [2 J
033 133 062 112

The above sequence erases all of the display. All lines are erased, changed to single-width, and the cursor does not move.

Reports

Reports – Reports are transmitted by the terminal in response to requests from the computer. Reports determine the type of terminal, the status of the terminal, and the cursor position. The report requests and responses are as follows.

Device Status Report (DSR)

ESC [5 n
033 133 065 156

The above sequence is the computer request for a status report (using a DSR sequence).

ESC [0 n
033 133 060 156

The above sequence is the response that the terminal is ready, no malfunctions detected.

ESC [3 n
033 133 063 156

The above sequence is the response that the terminal is malfunctioning, error in self-test. Reset and retry.

ESC [6 n
033 133 066 156

The above sequence is the computer request for a cursor position report from terminal.

Cursor Position Report (CPR)

ESC [PI ; Pc R
033 133 *** 073 *** 122

The above sequence is the terminal report of the cursor position in response to DSR sequence from the computer. PI indicates the line and Pc indicates the column. No parameters, or parameters of 0, indicate the cursor is at home position. Numbering of lines depends on origin mode (DE-COM).

Device Attributes (DA)

ESC [c or ESC [0 c
033 133 143 033 133 060 143

The above sequence is the computer request for the terminal to identify itself.

Identify Terminal (DECID)

ESC Z
033 132

The above sequence is the computer request for the terminal to identify itself. The terminal uses device attributes (DA) to respond. The DECID sequence may not be supported in future DIGITAL terminals. Therefore, any new software should use device attributes.

Device Attributes (DA)

ESC [? 1 ; 0 c
033 133 077 061 073 060 143

The above sequence is the terminal response of VT101. (It is the same as VT100 with no options.)

Reset

Reset – Reset initializes the terminal and causes it to perform the internal power-up self-test, erases the input buffer, and uses the SET-UP selections in user memory. Characters received while the terminal is performing a reset are lost. Therefore, the computer may act in one of two ways:

1. If the auto XON/XOFF feature is used, immediately after sending the reset sequence, the computer may assume an XOFF from the terminal. The computer sends no more characters until it receives XON. The terminal transmits XON only after it completes the reset.
2. If the first method cannot be used, a delay of no less than 10 seconds may be used to allow the terminal to complete the function. This method, however, does not guarantee against loss of characters when an error is detected.

The terminal disconnects from the communication line during a reset. After a reset, *keypad numeric mode (DECKPNM) is selected, cursor key mode (DECCKM) and origin mode (DECOM) are reset. The top and bottom margins (scrolling region) are selected for the complete screen (DECSTBM)*. Use the following sequence to reset the terminal.

Reset to Initial State (RIS)

ESC c
033 143

The above sequence resets the terminal to its initial state.

Tests

Tests – DECTST selects the self-tests used to verify correct operation of the terminal. Self-tests provide error indications on the keyboard indicators or screen. Refer to Chapter 8 for the meanings of displayed errors. The test results (pass or fail) are also reported to the computer using a device status report (DSR) sequence.

Characters received while the terminal is performing a test are lost. Therefore, the computer may act in one of two ways:

1. If the auto XON/XOFF feature is used, immediately after sending the invoke confidence test sequence, the computer may assume an XOFF from the terminal. The computer sends no more characters until it receives XON. The terminal transmits XON only after it completes the test.
2. When the first method cannot be used, a delay of no less than 10 seconds may be used to allow the terminal to complete the function. This method, however, does not guarantee against loss of characters when a self-test error is detected.

Use the following sequences to select terminal self-tests.

NOTE: DECTST causes the terminal to disconnect from the communication line and erase both the input and keyboard character buffers.

Invoke Confidence Test (DECTST)

ESC [2 ; 1 y
033 133 062 073 061 171

The above sequence is the power-up test. The terminal resets and performs power-up test.

ESC [2 ; 2 y
033 133 062 073 062 171

The above sequence is the data loopback test. The test connector is used.

ESC [2 ; 9 y
033 133 062 073 071 171

The above sequence repeats power-up test continuously until failure or power off.

ESC [2 ; 1 0 y
033 133 062 073 061 060 171

The above sequence repeats data loopback test continuously until failure or power off. This sequence uses the test connector.

Adjustments

Adjustments – A screen alignment pattern is provided to allow field service personnel to adjust the terminal screen. Use the following sequence to display the screen alignment pattern.

Screen Alignment Display (DECALN)

ESC # 8
033 043 070

The above sequence fills screen with uppercase **E**s for screen focus and alignment. It is used by DIGITAL manufacturing and Field Service personnel.

Keyboard Indicators

Keyboard Indicators – Indicators (LEDs) L1 through L4 are programmable. They can be assigned particular meanings for specific applications. Use the following sequences to turn the indicators on or off.

Load LEDs (DECLL)

ESC [0 q
033 133 060 161

The above sequence turns L1-L4 off.

ESC [1 q
033 133 061 161

The above sequence turns L1 on.

ESC [2 q
033 133 062 161

The above sequence turns L2 on.

ESC [3 q
033 133 063 161

The above sequence turns L3 on.

ESC [4 q
033 133 064 161

The above sequence turns L4 on.

VT52 Compatible Sequences

VT52 compatible sequences meet private DIGITAL standards. Therefore, the terminal can use existing software designed for previous terminals (such as the VT52). VT52 compatibility is selected from the keyboard in SET-UP (refer to Chapter 2) or by the computer using a sequence. (Refer to the ANSI compatible sequences described in this chapter.)

Modes

Modes – While in VT52 mode, most terminal features cannot be selected using sequences. However, the following three modes *can* be selected using sequences: ANSI mode, application keypad mode on, and application keypad mode off (numeric keypad mode).

ANSI/VT52 Compatibility

ANSI/VT52 Compatibility – The terminal is compatible with both ANSI and private DIGITAL standards. Therefore, new software that meets the ANSI standards and existing software designed for previous terminals (such as the VT52) can be used. ANSI compatible sequences meet standards X3.64-1979 and X3.41-1974. The terminal features selected in ANSI mode are also used in VT52 mode. However, these features usually cannot be changed in VT52 mode. Use the following sequence to select ANSI compatibility.

ANSI Mode (DECANM)

ESC <
033 074

All sequences are interpreted according to ANSI standards X3.64-1979 and X3.41-1974. The VT52 escape sequences described in this section are not recognized.

Cursor Positioning

Cursor Positioning – The cursor indicates the location of the active position. This is where the next character is displayed. In VT52 mode, the margins used are selected in ANSI mode. If margins are not selected, the terminal uses the complete screen. The cursor moves:

- One column to the right when a character is displayed.
- One line down when a linefeed, form feed, or vertical tab is received (linefeed/new line may cause the cursor to also move to the left margin).
- To the left margin when a carriage return is received.
- One column to the left when a backspace is received.
- To the next tab stop to the right, or right margin, if no tabs are set and a horizontal tab character is received.

The following sequences also move the cursor.

Cursor Up

ESC A
033 101

The above sequence moves the cursor up one line in the same column. Cursor stops at the top of the screen.

Cursor Down

ESC B
033 102

The above sequence moves the cursor down one line in the same column. Cursor stops at the bottom of the screen.

Cursor Right

ESC C
033 103

The above sequence moves the cursor one column to the right. Cursor stops at the right margin.

Cursor Left

ESC D
033 104

The above sequence moves the cursor one column to the left. Cursor stops at the left margin.

Cursor to Home

ESC H
033 110

The above sequence moves the cursor to the home position.

Direct Cursor Address

ESC Y line column
033 131 *** ***

The above sequence moves the cursor to the specified line and column. The line and column numbers are sent as the ASCII characters whose codes are the octal number plus octal 037. For example, line 1 column 8 parameters are octal 040 (first line) and octal 050 (eighth column).

Reverse Line Feed

ESC I
033 111

The above sequence moves the cursor up one line in the same column. If the cursor is at the top margin, a scroll down is performed.

Keypad Character Selection

Keypad Character Selection – The numeric keypad generates either numeric characters or control functions. Select alternate (application) keypad mode to generate control functions. Exit application keypad mode (select numeric keypad mode) to generate numeric characters. Table 4-14 lists the characters generated by the keypad keys. Use the following sequences to enter and exit application keypad mode.

NOTE: Power-up or reset causes the terminal to exit application keypad mode (select numeric keypad mode).

Enter Application Keypad Mode

ESC =
033 075

Numeric keypad keys generate sequences used by the application program.

Exit Application Keypad Mode (numeric keypad mode)

ESC >
033 076

Numeric keypad keys generate characters corresponding to the numeric, comma, period, and minus sign keys on the main keyboard.

Table 4-14 VT52 Numeric Keypad Codes

Key	Numeric Keypad Mode	Application Keypad Mode
0	0 060	ESC ? p 033 077 160
1	1 061	ESC ? q 033 077 161
2	2 062	ESC ? r 033 077 162
3	3 063	ESC ? s 033 077 163
4	4 064	ESC ? t 033 077 164
5	5 065	ESC ? u 033 077 165
6	6 066	ESC ? v 033 077 166
7	7 067	ESC ? w 033 077 167
8	8 070	ESC ? x 033 077 170
9	9 071	ESC ? y 033 077 171
-(minus)	-(minus) 055	ESC ? m* 033 077 155
,(comma)	,(comma) 054	ESC ? l* 033 077 154
.(period)	.(period) 056	ESC ? n 033 077 156

* These sequences are not generated by the VT52 terminal.

Table 4-14 VT52 Numeric Keypad Codes (Cont)

Key	Numeric Keypad Mode			Application Keypad Mode		
ENTER†	CR 015 or 015	CR 015	LF 012	ESC 033	?	M 115
PF1	ESC 033	P 120		ESC 033	P 120	
PF2	ESC 033	Q 121		ESC 033	Q 121	
PF3	ESC 033	R 122		ESC 033	R 122	
PF4	ESC 033	S 123		ESC 033	S 123	

† When numeric keypad mode is selected (application keypad mode off), **ENTER** generates the same characters as **RETURN**. The return character code can be changed by the linefeed/new line feature. When off, this feature causes the key to generate a single control character (CR, octal 015). When on, this feature causes the key to generate two characters (CR, octal 015 and LF, octal 012).

Character Sets and Selection

Character Sets and Selection – In VT52 mode, the terminal uses either character set selected in SET-UP (US/UK) or the special character and line drawing character set. Tables 4-11 and 4-12 show the US and UK character sets. Table 4-13 shows the special character and line drawing character set. Table 4-15 compares the VT101 special character and line drawing character set to the VT52 graphics mode (character set). Use the following sequences to select the character set.

Enter Graphics Mode

ESC F
033 106

The above sequence selects the special character and line drawing character set.

Exit Graphics Mode

ESC G
033 107

The above sequence selects the character set selected in SET-UP.

Table 4-15 Special Characters and Line Drawing Set and Graphics Mode Comparison

Octal Code	US/UK Set	Special Characters and Line Drawing Set	VT52 in Graphics Mode*
137	-	Blank	Blank
140	/	♦ Diamond	Reserved
141	a	■ Checkerboard (error indicator)	Solid rectangle
142	b	↔ Horizontal tab	1/
143	c	↑ Form feed	3/
144	d	↓ Carriage return	5/
145	e	↖ Linefeed	7/
146	f	° Degree symbol	Degrees
147	g	± Plus/minus	Plus or minus
150	h	↙ New line	Right arrow
151	i	↘ Vertical tab	Ellipsis (dots)
152	j	↓ Lower-right corner	Divide by
153	k	↑ Upper-right corner	Down arrow
154	l	↖ Upper-left corner	Bar at scan 0
155	m	↙ Lower-left corner	Bar at scan 1
156	n	† Crossing lines	Bar at scan 2
157	o	— Horizontal line - scan 1	Bar at scan 3
160	p	— Horizontal line - scan 3	Bar at scan 4
161	q	— Horizontal line - scan 5	Bar at scan 5
162	r	— Horizontal line - scan 7	Bar at scan 6
163	s	— Horizontal line - scan 9	Bar at scan 7
164	t	⊣ Left "T"	Subscript 0
165	u	⇒ Right "T"	Subscript 1
166	v	⊥ Bottom "T"	Subscript 2
167	w	⊤ Top "T"	Subscript 3
170	x	| Vertical bar	Subscript 4
171	y	≤ Less than or equal to	Subscript 5
172	z	≥ Greater than or equal to	Subscript 6
173	{	π Pi	Subscript 7
174	|	≠ Not equal to	Subscript 8
175	}	£ UK pound sign	Subscript 9
176	~	• Centered dot	Paragraph

* Not available in VT101.

Erasing

Erasing – Erasing removes characters from the screen. When characters are erased, they are lost. Use the following sequences to erase characters from the screen.

Erase to End of Line

ESC K
033 113

The above sequence erases all characters from the cursor to the end of the current line, including the cursor position. The cursor does not move.

Erase to End of Screen

ESC J
033 112

The above sequence erases all characters from the cursor to the end of the screen, including the cursor position. The cursor does not move.

Reports

Reports – Reports are transmitted by the terminal in response to a request from the computer. The terminal generates only one report in VT52 mode. The following sequences are the request for a report and the response to the report request.

Identify

ESC Z
033 132

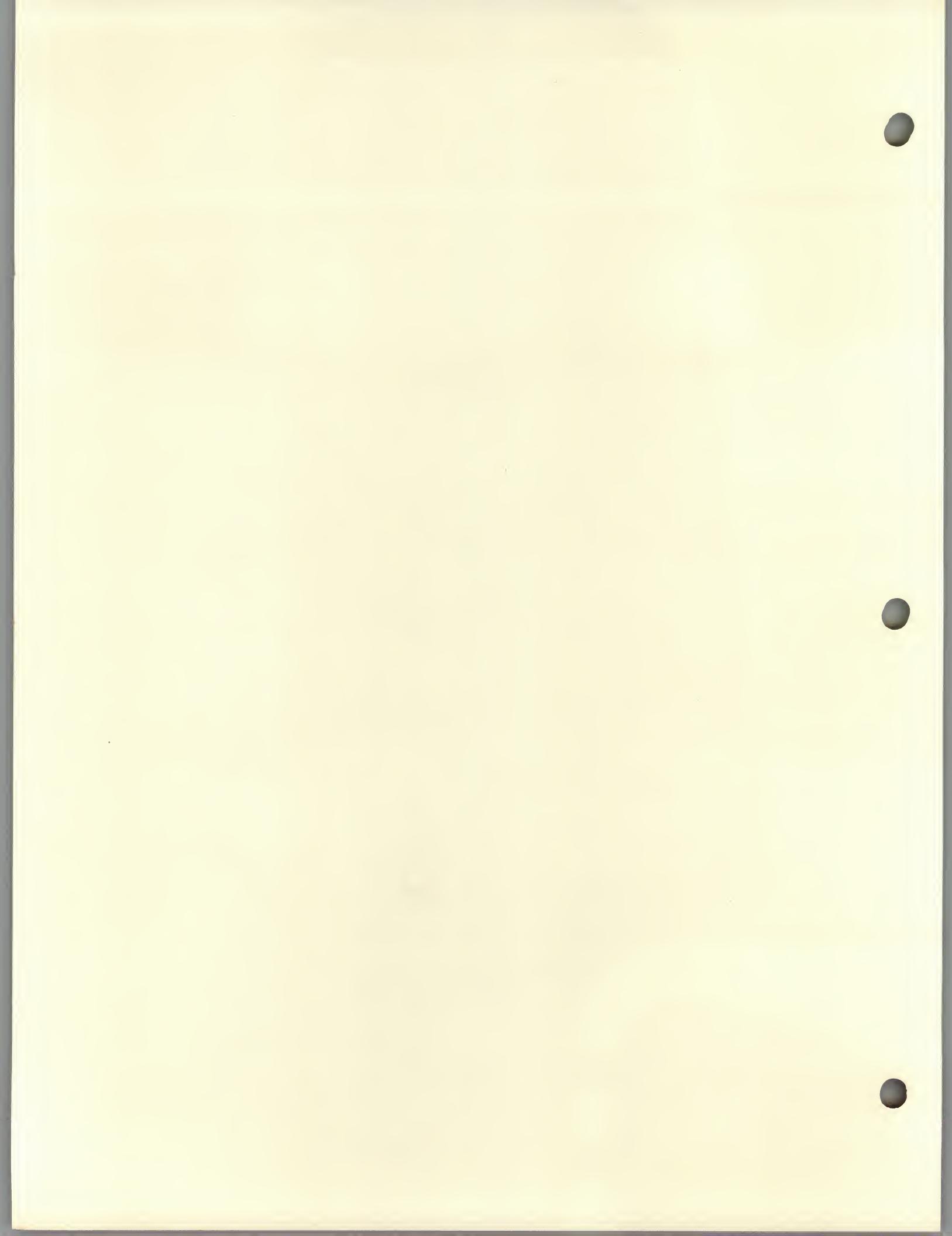
The above sequence causes the terminal to send an identify sequence to the computer.

ESC / Z
033 057 132

The above sequence is the VT101 response to Identify. (It is the same as the VT52 terminal.)

Communication

!



5

COMMUNICATION

GENERAL

This chapter describes how the terminal communicates with a computer. A description of the communication (modem) connector and its signals is provided. This chapter also describes the terminal's communication features.

NOTE: The 20 mA current loop interface is described in Chapter 7.

CONNECTING TO THE COMPUTER

The terminal's communication (modem) interface is a DB-25 (EIA RS-232-C type) male connector mounted on the back of the terminal (Figure 5-1). This interface meets Electronic Industry Association (EIA) standard RS-423, RS-232-C, and International Telegraph and Telephone Consultive Committee (CCITT) recommendation V.24 and V.28.

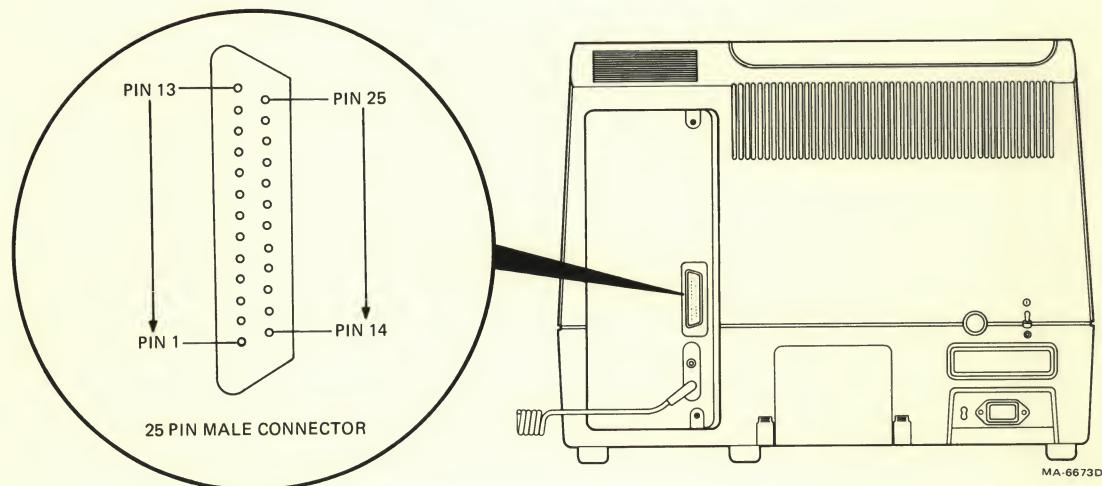


Figure 5-1 Communication (Modem) Connector Location and Pin Numbering

The terminal connects to a computer directly or through a common carrier facility (telephone line) (Figure 5-2). Modems are needed to connect the terminal to a computer using a telephone line. Modems change characters transmitted between the terminal and computer into signals that are transmitted over the telephone line. Several types of modems can be used with the terminal. When connecting the terminal to the computer using modems, the following must be selected.

1. A modem - The modem used by the terminal must be compatible with the modem used by the computer. Several types of modems can be used by the terminal. Table 5-1 lists the possible modems used on public switched telephone lines.

NOTE: The modems listed are examples of possible configurations. Equivalent modems supplied by other manufacturers may also be used.

DIGITAL DF02-AA and DF03-AA modems are equivalent to Bell 103J and 212A. DF02 operates at 300 baud; DF03 operates at 300 or 1200 baud.

2. The communication SET-UP features - The SET-UP must be compatible to the features of the computer and communication system. The communication features are described in the Serial Characters section of this chapter.

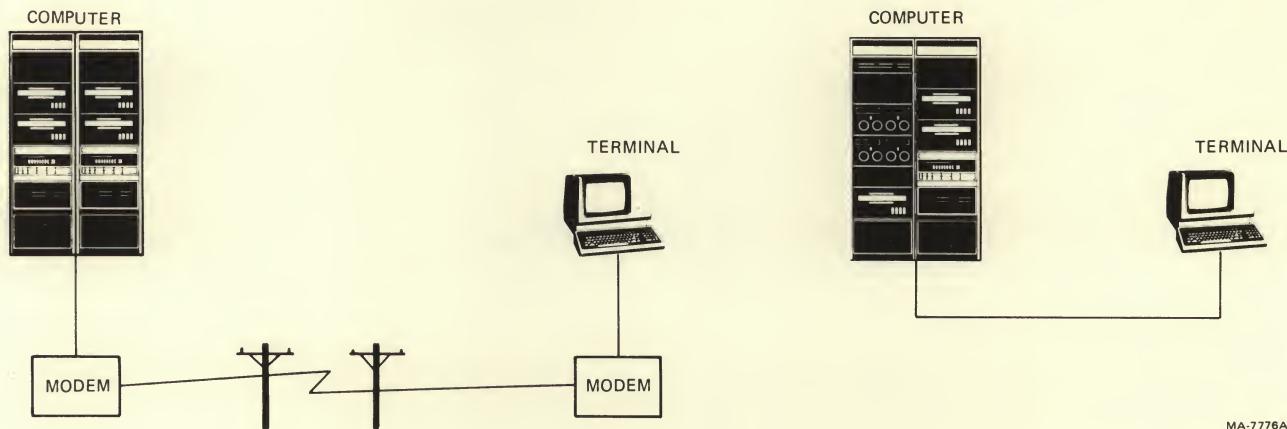


Figure 5-2 Connecting to the Computer

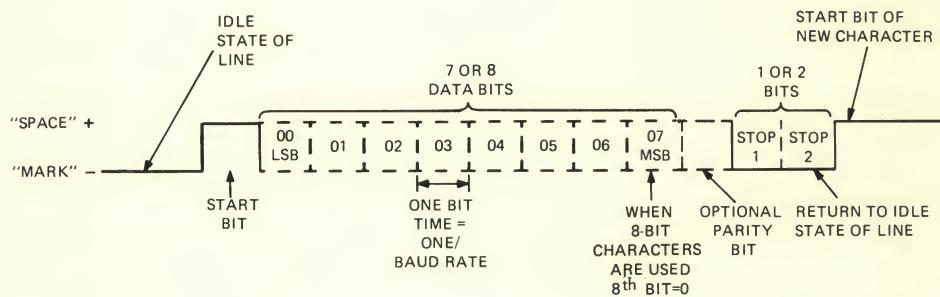
Table 5-1 Possible Bell Modem Configurations (Public Switched)

Communication Parameters	Manual Originate Only	Manual Answer Only	Manual Originate Answer	Auto Answer	Reverse Channel
300 baud	113A	113D	103A	103A	No
Full-duplex	113C	-	103J	103J	No
2-wire	-	-	-	113B	No
	-	-	-	113D	No
	-	-	212A	212A	No
1200 baud	-	-	212A	212A	No
Full-duplex					
2-wire					

Serial Characters

The terminal communicates using serial characters. Serial characters are transmitted using a start bit, 7 or 8 data bits, an optional parity bit, and 1 or 2 stop bits. Figure 5-3 is an example of the serial character format.

The number of data bits per character and parity are selected using the data/parity bits SET-UP feature. If 8-bit characters are selected, the last data bit is forced to the space (0) condition, and the eighth data bit is ignored when receiving characters. The data bits are transmitted with the least significant bit first. (Refer to ANSI X3.15-1976 for details on the serial character format.)



MR-1279
MA-7815

Figure 5-3 Serial Character Format

Character transmission errors of both transmitted and received characters are found using the parity bit. The data/parity bits SET-UP feature selects the type of parity. If parity is not selected, the parity bit is not transmitted and cannot be checked when received.

When parity is selected, the receive parity SET-UP feature determines if the parity of received characters is checked or ignored. However, received character parity can only be checked for odd or even parity; mark and space parity cannot be checked on received characters.

The number of stop bits (one or two) in a character is determined by the transmit and receive speed SET-UP features.

Break

Break can be transmitted by the terminal. Break is a transmitted space condition of 0.275 seconds \pm 10 percent. The computer response to break depends on the computer and software. A long break (space) disconnect is a transmitted space condition of 3.5 seconds \pm 10 percent, and the Data Terminal Ready (DTR) interface signal is turned off.

NOTE: In some communication systems, a long break disconnect causes the modems to disconnect from (hang up) the communication line.

Full-Duplex Communication

Full-duplex communication allows characters to be transmitted and received in both directions at the same time. The terminal can communicate with the computer regardless of the received modem control signals. Table 5-2 describes the signals used. The terminal uses only the connector signals described.

Table 5-2 EIA Connector Signals

Pin	Name	Mnemonic	CCITT/EIA Designation	Description
1	Protective ground	PGND	101/AA	This signal is connected to the VT101 chassis and to external ground through the ac power cord. Use of this conductor for reference potential purposes is not allowed.
2	Transmitted data	TXD	103/BA	From VT101 The VT101 transmits serial characters and breaks on this circuit. This conductor is in the mark state when characters or breaks are not being transmitted.

Table 5-2 EIA Connector Signals (Cont)

Pin	Name	Mnemonic	CCITT/EIA Designation	Description
3	Received data	RXD	104/BB	To VT101 The VT101 receives serial characters from the computer.
4	Request to send	RTS	105/CA	From VT101 This signal is on whenever the VT101 is on. The signal turns off during a reset.
7	Signal ground	SGND	102/AB	This conductor is the common ground reference potential for all connector signals. Also, it is connected to the VT101 chassis.
8	Receive line signal detector	RLSD	109/CF	To VT101 This signal is also called Carrier Detect. The condition is not needed to transmit data. However, when this signal is turned off by loss of carrier detect from the modem, the VT101 performs a disconnect.
20	Data terminal ready	DTR	108.2/CD	From VT101 This signal is on except when the following conditions exist: <ul style="list-style-type: none"> • VT101 is not on, • VT101 is off-line, • During a reset, and • 3.5 seconds during a Long Break Disconnect
23	Speed select	SPDSL	111/CH	From VT101 This signal is also called Secondary Request to Send. This signal is off at all times.

Connection – The terminal assumes it is connected to the computer whenever the DTR signal is on. Communication is allowed regardless of the condition of other modem control lines. DTR is on at all times except when the terminal is off-line, or performing a long break disconnect.

Disconnection – The terminal disconnects (hangs up) the communication (telephone) line by turning Data Terminal Ready off. A disconnect is performed when:

1. The terminal is switched off-line
2. A reset or general default is performed
3. A long break disconnect is performed (**SHIFT** and **BREAK** key sequence)
4. The received line signal detector is turned off by loss of carrier detect from the modem

INPUT BUFFER OVERFLOW PREVENTION

When the terminal receives a character (other than NUL), it is placed in a 128-character input buffer. The input buffer holds the received character until processed. When processed, the character is removed from the input buffer.

If characters are received by the input buffer faster than they are processed, the input buffer fills. When it is full, all newly received characters are lost and the substitute character (☒) is displayed. There are three ways to prevent input buffer overflow.

1. XON/XOFF characters (recommended)
2. Fill characters
3. Low speed operation

XON/XOFF Characters

When the auto XON/XOFF SET-UP feature is selected, the XON and XOFF control characters are used to prevent input buffer overflows. These characters indicate when the buffer is almost empty or full. When the terminal's 128-character input buffer holds 32 characters, the terminal automatically transmits XOFF (DC3, octal 023). The computer should stop transmitting characters to prevent an input buffer overflow.

If the computer fails to respond to the XOFF character, the input buffer continues to fill. The terminal transmits a second XOFF when the input buffer holds 112 characters. This second XOFF is a last request to the computer to stop transmitting characters.

The terminal continues to remove characters from the input buffer. When the input buffer contains 16 characters, the terminal automatically transmits XON (DC1, octal 021), requesting the computer to continue transmission.

To determine how fast the computer must respond to the first XOFF character to avoid input buffer overflow, use the following formulas.

$$\text{Number of characters to overflow} = 96 - [3 \times (\text{receiver speed} / \text{transmit speed})]$$

$$\text{Time to respond to XOFF (in seconds)} = \text{Number of characters to overflow} \times (\text{bits per character} + \text{parity bit} + \text{number of stop bits} + 1) / \text{receiver speed}.$$

Example 1

The terminal is transmitting 8-bit characters with no parity at 1200 baud and receiving at 1200 baud. The terminal transmits the first XOFF, and the computer must stop transmitting within 0.775 seconds or the input buffer overflows.

$$\text{Number of characters to overflow} = 96 - [3 \times 1200 / 1200] = 93 \text{ characters}$$

$$\text{Time to respond to XOFF} = 93 \times (8 + 0 + 1 + 1) / 1200 = 0.775 \text{ seconds}$$

Example 2

The terminal is transmitting 7-bit characters with parity and receiving at 300 baud. The terminal transmits the first XOFF, and the computer must stop transmitting within 3.1 seconds or the input buffer overflows.

$$\text{Number of characters to overflow} = 96 - [3 \times 300 / 300] = 93 \text{ characters}$$

$$\text{Time to respond to XOFF} = 93 \times (7 + 1 + 1 + 1) / 300 = 3.1 \text{ seconds}$$

NOTE: Immediately after sending the reset or invoke confidence test sequences, the computer may assume an XOFF from the terminal. The computer sends no more characters until it receives XON. The terminal transmits XON only after it completes the specified function.

Fill Characters

The computer can use fill characters (Null, octal 000 is recommended) to prevent input buffer overflows. The null character is ignored when it is received by the terminal. Since the null character is not processed, the terminal can process characters already received while receiving fill characters.

Fill characters are transmitted to the terminal after each control function or display character. The number of fill characters needed depends on the control function and the terminal's receive speed. Table 5-3 lists the number of fill characters used when transmitting to the terminal.

Table 5-3 VT100/VT101 Fill Characters

Baud Rate	Parameter	IND,LF, NEL,RI (Smooth Scroll)	DECCOLM	DECALN	ED (132 Col)	ED (80 Col)	IND,LF, NEL,RI (Jump Scroll)	EL (132 Col)	EL (80 Col)	DECINLM	All Others Except RIS and DECTST
19200	384	243	243	132	97	60	5	4	2		2
9600	192	122	122	66	48	30	2	2	1		1
4800	96	61	61	33	24	15	1	1	1		0
3600	72	46	46	25	18	12	1	0	0		0
2400	48	30	30	16	12	7	1	0	0		0
2000	40	25	25	14	10	6	0	0	0		0
1800	36	23	23	12	9	6	0	0	0		0
1200	24	15	15	8	6	4	0	0	0		0
600	12	8	8	4	3	2	0	0	0		0
300	6	4	4	2	2	1	0	0	0		0
200	4	3	3	1	1	1	0	0	0		0
150	3	2	2	1	1	0	0	0	0		0
134.5	3	2	2	1	1	0	0	0	0		0
110	2	1	1	1	1	0	0	0	0		0
75	2	1	1	1	0	0	0	0	0		0
50	1	1	1	0	0	0	0	0	0		0

Low Speed Operation

Input buffer overflows are prevented when the terminal uses a slow receive speed. Low speed operation allows the terminal to process a received character before the next character is received. Therefore, the input buffer is always ready to receive characters. Use the following rules during low speed operation to prevent input buffer overflows.

1. The computer must never send the ESC code to the terminal.
2. The receive speed of the terminal must be 4800 baud or less.
3. The smooth scroll feature must not be used.
4. Immediately after sending the reset or invoke confidence test sequences, a delay of no less than 10 seconds is used to allow the terminal to complete the function. This does not guarantee against loss of characters when a test error is detected.

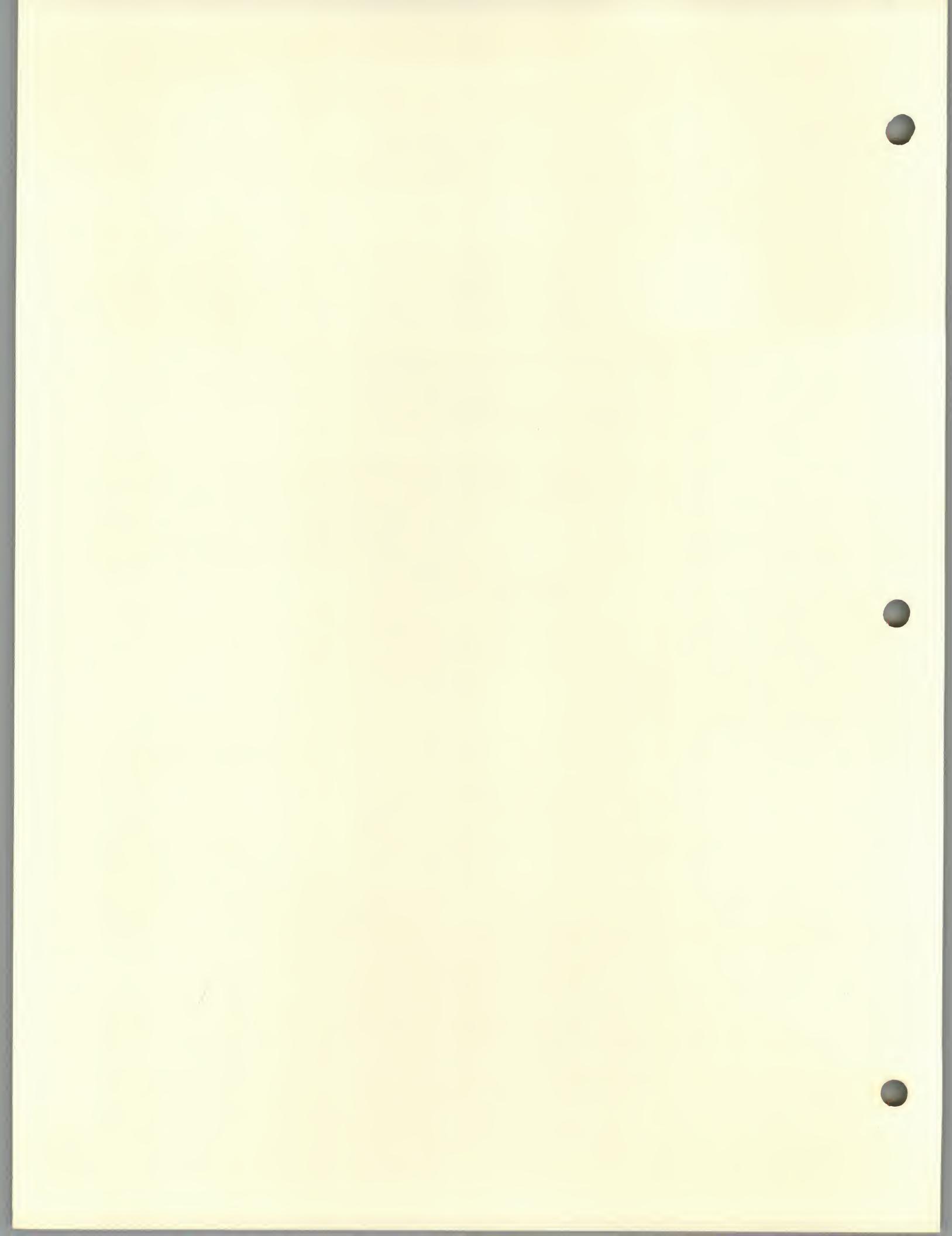
KEYBOARD TRANSMIT BUFFER

This buffer holds characters generated by the terminal before they are transmitted to the computer. The computer can use the XON (DC1, octal 021) and XOFF (DC3, octal 023) characters to control the transmission of characters from the terminal.

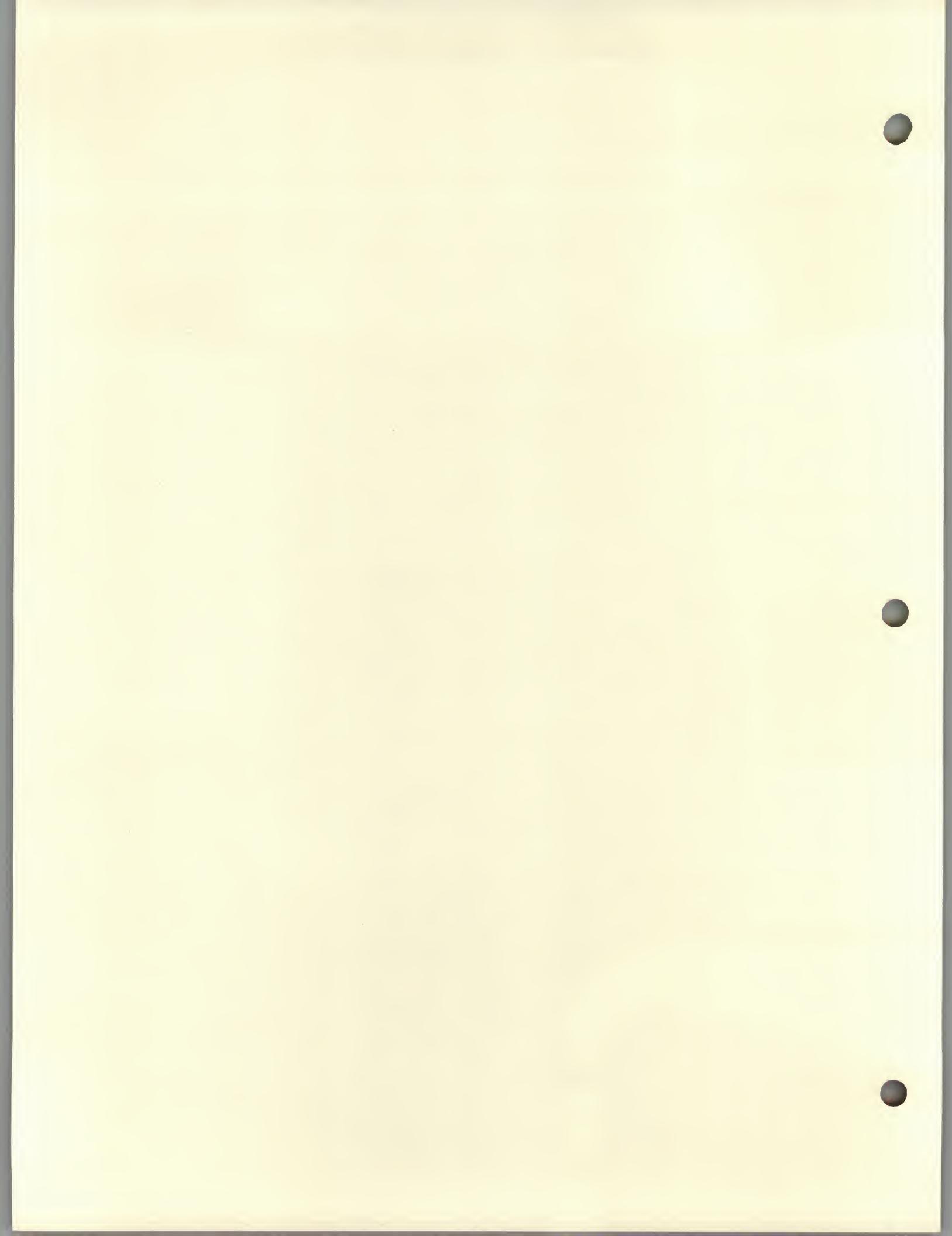
NOTE: Only the XON and XOFF characters are used to control the transmission of characters from the terminal to the computer. The keyboard buffer responds to these characters regardless of the auto XON/XOFF SET-UP feature selection.

Receipt of XOFF stops the terminal from transmitting any characters except XOFF and XON. Keystrokes are stored in a keyboard buffer. If the keyboard buffer overflows, KBD LOCKED indicator turns on and keyclicks stop (if the keyclick SET-UP feature is on).

When XON is received, the transmission of characters continues. Also, entering and exiting SET-UP turns off the KBD LOCKED indicator and allows the terminal to transmit characters. However, characters transmitted after entering and exiting SET-UP may be lost if the computer is not ready to receive characters. When the keyboard buffer is empty, the KBD LOCKED indicator is off and keyclicks occur when keys are pressed (if the keyclick SET-UP feature is on).



Installation



6 INSTALLATION

GENERAL

This chapter provides information used to unpack, pack, and install the terminal. The installation procedure describes how to select the input voltage switch and fuse. A step-by-step power-up and checkout procedure is provided.

SITE CONSIDERATIONS

The terminal consists of a video monitor and detached keyboard. Dimensions are shown in Figure 6-1. The following lists the environmental and power specifications.

Temperature	10° to 40° C (50° to 104° F)
Relative humidity	10 to 90 percent with a maximum wet bulb temperature of 28° C (82° F) and a maximum dewpoint of 2° C (36° F) noncondensing
Input voltage	99-128 Vac (115 V setting) with a 1.25 fuse (DIGITAL PN 9000020-01) 198-256 Vac (230 V setting) with a 0.75 slow blow fuse (DIGITAL PN 12112337-00) (switch-selectable) 87-107 Vac (100 V setting) 222-268 Vac (250 V setting)
Power consumption	70 W
Power receptacle	Nonswitched, grounded

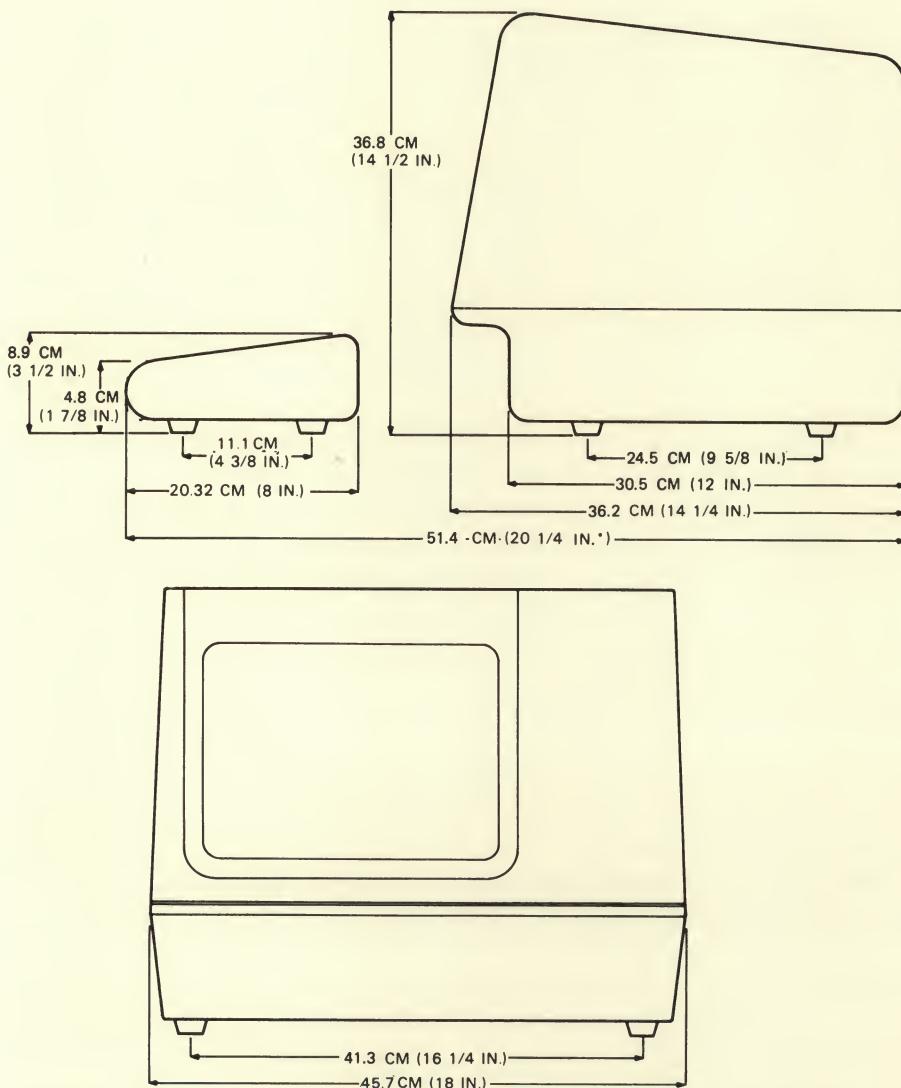
When installing the terminal, make sure that all power and signal cables are free from any stress, sharp bends, or obstructions. Also, be sure to provide access to the monitor controls on the back of the terminal.

Do not block the air flow around the terminal. Several ventilation openings prevent the terminal from overheating. Do not block these openings by placing objects on top of or under the terminal. Also, do not allow liquids, coins, paper clips, and other objects to enter these ventilation openings. These objects may damage the terminal. For this reason, do not put drinks or metal objects on the top of terminal.

The terminal can be placed on a desk or tabletop. However, people usually prefer the keyboard at standard typewriter-table height rather than desk height. Terminal tables and stands are available from the DIGITAL Accessories and Supplies Group. (Refer to Chapter 9 for more information on accessories.)

Position the terminal to avoid reflected light. The terminal should be facing away from light sources that reflect off the screen. However, if reflected light is a problem, filter screens are available from the DIGITAL Accessories and Supplies Group.

For installations with static electricity problems, static mats are available from DIGITAL Accessories and Supplies Group.



*MEASUREMENT TAKEN WITH THE KEYBOARD PLACED FLUSH TO FRONT OF TERMINAL UNDER UNDERCUT.

MA-1991

Figure 6-1 VT101 Terminal Dimensions

UNPACKING AND INSPECTION PROCEDURE

The terminal is packed in a carton with the following items.

Monitor
Keyboard
AC power cord(s)
SET-UP label
User guide
Programming reference card

Figure 6-2 shows the packaging used for the terminal. Use the following procedure to unpack the terminal from the shipping carton.

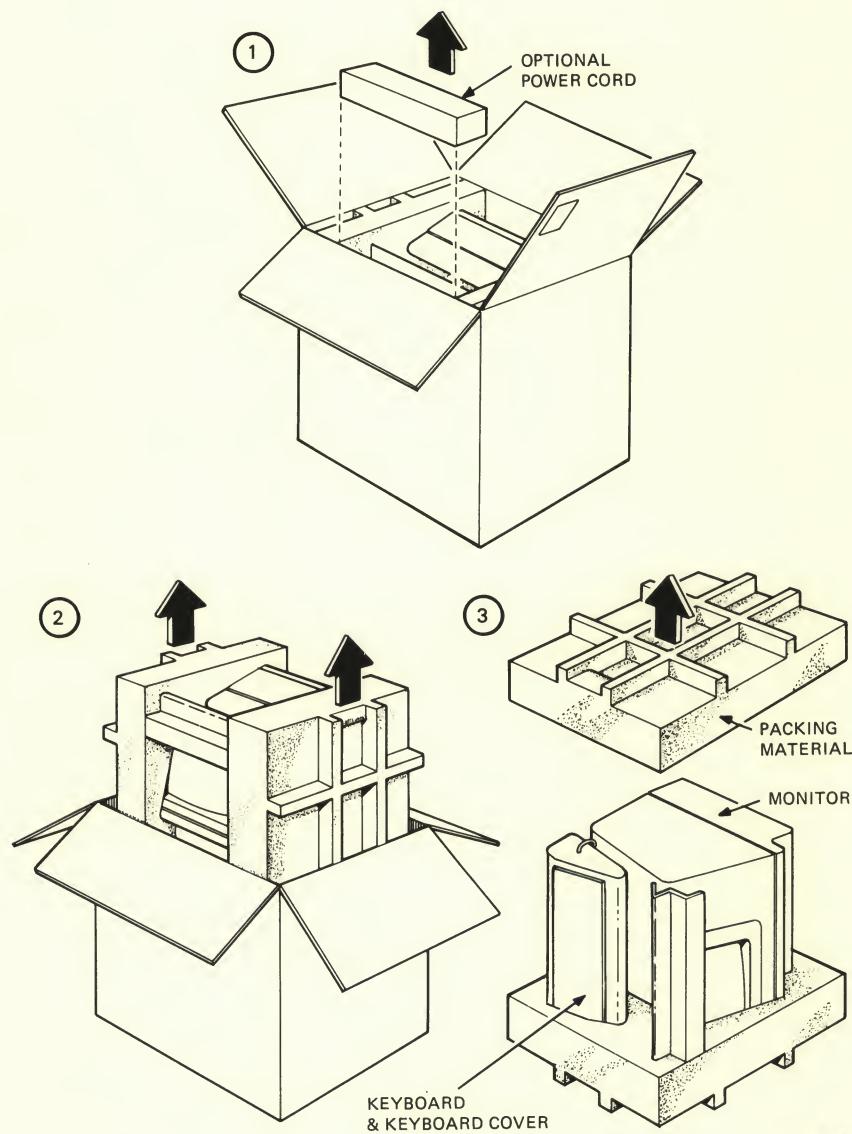


Figure 6-2 Terminal Packing

1. Cut the carton sealing tape and open the carton flaps.
2. Lift the non-US power cord carton out of the carton. The non-US power cord is supplied with some variations of the terminal.

NOTE: All terminals are shipped with a US power cord.

3. Lift the terminal out of the carton using the handles provided in the packing material. Place the terminal and packing material on the left side (when facing the front of the terminal).
4. Remove the packing material on the right side.
5. Remove the keyboard cover and keyboard, and then the monitor from the remaining packing material.
6. Remove the plastic bags covering the monitor and keyboard.
7. Inspect the terminal for damage.

NOTE: Notify the carrier and your local DIGITAL sales office of any damage.

8. Install the terminal using the installation procedure in this chapter.

PACKING PROCEDURE

Use the following procedure to pack the terminal for shipment. (Figure 6-2 shows the packing, Figure 6-3 shows switch and cable locations.)

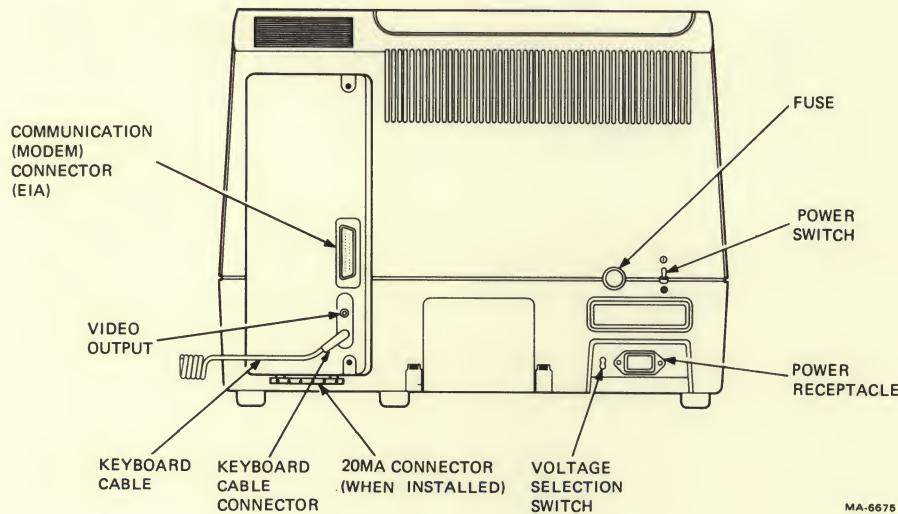


Figure 6-3 Monitor Controls and Connector Locations

1. Turn the power switch to the off (0) position.
2. Disconnect all cables at the back of the terminal.
3. Place the monitor and keyboards in plastic bags.
4. Place the packing material of the left side (facing the front of the terminal) on a flat surface with the cutouts facing up. Place the monitor into the large cutout.
5. Route the keyboard cable behind the keyboard. Place the connector in the small cutout.
6. Place the keyboard cover over the keys of the keyboard and then place the keyboard into the small cutout.
7. Place the packing material of the right side over the monitor and keyboard.
8. Put the packaged terminal and power cord into the shipping carton. Fold the carton flaps and tape the carton closed with sealing tape.

INSTALLATION PROCEDURE

Use the following procedure to install the terminal. (Refer to Figure 6-3 for switch and cable locations.)

1. Perform the unpacking and inspection procedure described in this chapter.
2. Check the terminal for the correct voltage range selection. The terminal can operate with either 120 or 220-240 volt input power.

CAUTION: Failure to select the correct voltage range will damage the terminal.

A label over the power receptacle indicates the factory selected input voltage range. Check this label, the voltage selection switch, and the fuse for the correct voltage range. Be sure the voltage range of the terminal is the same as your local ac power source. The following procedures describe how to select the correct input voltage range.

To use the terminal with 120 volts, perform the following procedure.

- a. Set the voltage selection switch to 115* (operating range 99-128 volts).
- b. Remove the fuse holder cap by pressing it in and turning it counterclockwise. Check for a 1.25 ampere fuse (DIGITAL PN 9000020-01). Replace the fuse and the fuse holder cap by pressing in and turning clockwise.

To use the terminal with 220-240 volts, perform the following procedure.

- a. Set the voltage selection switch to 230* (operating range 198-256 volts).
- b. Remove the fuse holder cap by pressing it in and turning it counterclockwise. Check the fuse for a 0.75 ampere slow blow (DIGITAL PN 1211237-00). Replace the fuse and fuse holder cap by pressing in and turning clockwise.
2. Remove the backing paper to attach the self-sticking SET-UP label to the bottom of the keyboard.
3. If necessary, install the 20 mA current loop option (VT1XX-CA). Perform the option installation and checkout procedures described in Chapter 7.
4. Place the keyboard in front of the terminal. Plug the keyboard into the keyboard connector.
5. Connect the communication cable to the terminal. Refer to the Communication Cables section of this chapter for more information about cables. Also, refer to Chapter 5 for information about connector use and signal/pin definitions.
6. Connect the external video device, such as a video monitor to the video output connectors. The terminal uses a 75-ohm BNC connector to interface to the external device. Detailed specifications for this output are listed in Appendix A.
8. Connect the ac power cable to the terminal and the other end to a nonswitched, grounded ac power receptacle.

NOTE: Check that the power switch is in the off (0) position before connecting the power cord.

9. Perform the power-up and checkout procedure described in this chapter.

*On some terminals the voltage selection switch reads 100 (operating range 87-107) and 250 (operating range 222-268).

COMMUNICATION CABLES

Communication cables for the terminal can be ordered from the DIGITAL Accessories and Supplies Group. Part numbers and ordering information for these cables is supplied in Chapter 9. Table 6-1 describes each communication cable used and Figure 6-4 shows connection examples for each cable.

Table 6-1 Interface Cables

Number/ Length	Connector Types	Function
BC22A-10 (10 ft)	RS-232 (female) to RS-232 (female)	Null modem – Direct connection between VT101 and computer (6-conductor cable)
BC22A-25 (25 ft)	RS-232 (female) to RS-232 (female)	Null modem – Direct connection between VT101 and computer (6-conductor cable)
BC22B-10 (10 ft)	RS-232 (male) to RS-232 (female)	Extension – Connects VT101 to a modem (14-conductor cable)
BC22B-25 (25 ft)	RS-232 (male) to RS-232 (female)	Extension – Connects VT101 to a modem (14-conductor cable)
BC03M-xx (variable length)	RS-232 (female) to RS-232 (female)	Null modem – Direct connection between VT101 and computer
BC05D-xx (variable length)	RS-232 (male)	Extension – Connects VT101 to a modem
BC05F-15 (15 ft)	Mate-N-Lok™ to Mate-N-Lok	20 mA – Direct connection between VT101 with a 20 mA option installed and a computer (supplied with 20 mA option)
BC05X-xx (variable length)	Mate-N-Lok to Mate-N-Lok	20 mA extension cable
30-10958-02 EIA: 20 mA:	RS-232 (male) to RS-232 (female) and 20 mA (male)	Connection between DF01-A acoustic coupler and VT101 EIA or 20 mA

™AMP, INC.

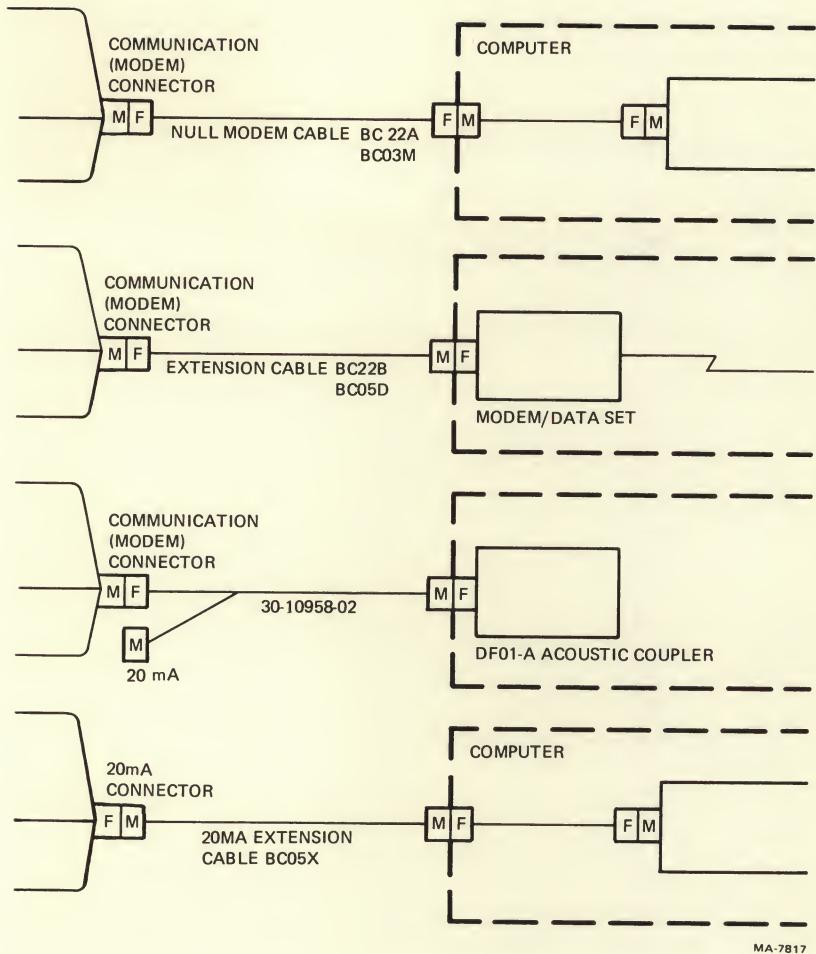


Figure 6-4 Cable Summary

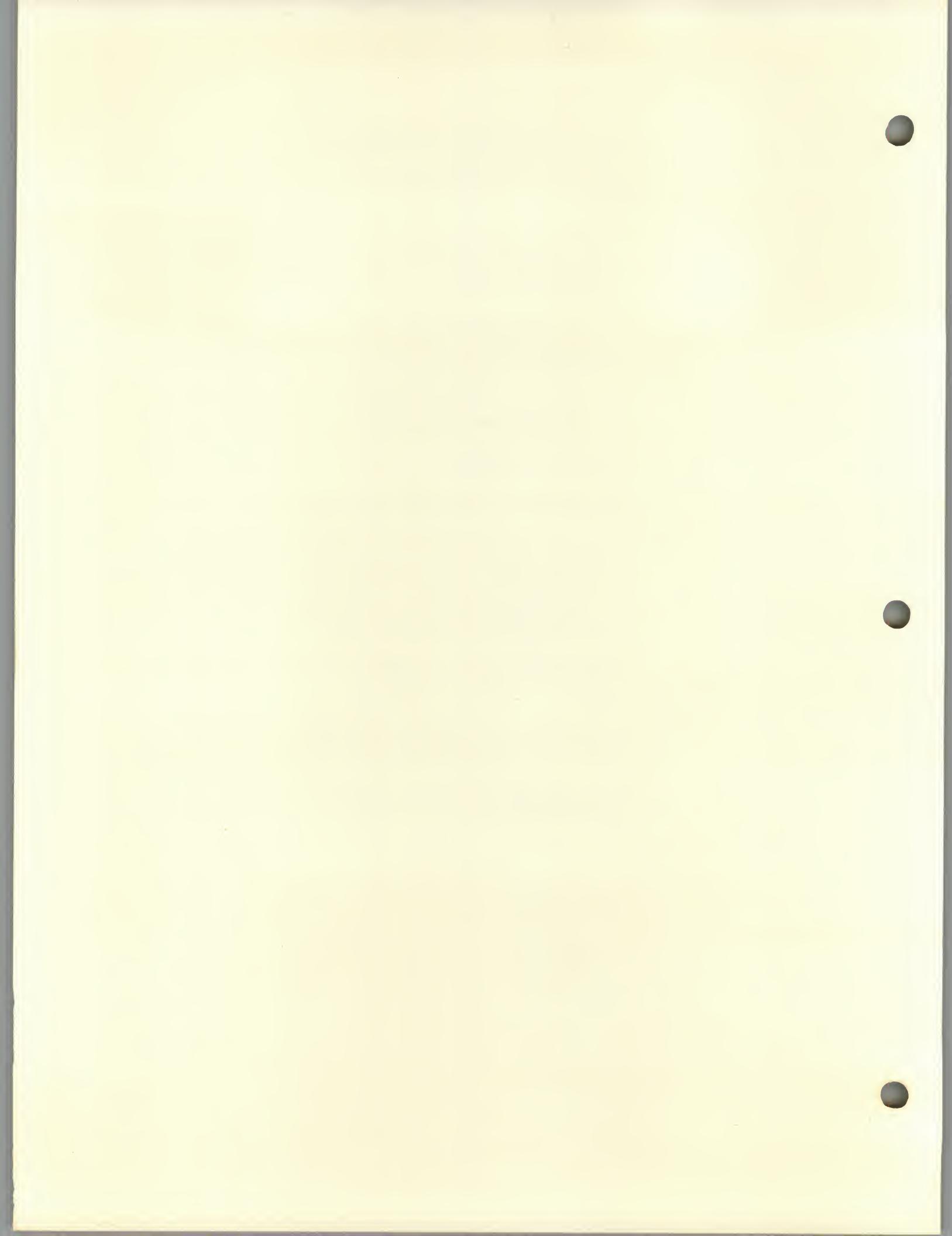
POWER-UP AND CHECKOUT PROCEDURE

A power-up self-test verifies correct operation of the terminal each time it is powered up. Use the following procedure to powerup and checkout the terminal.

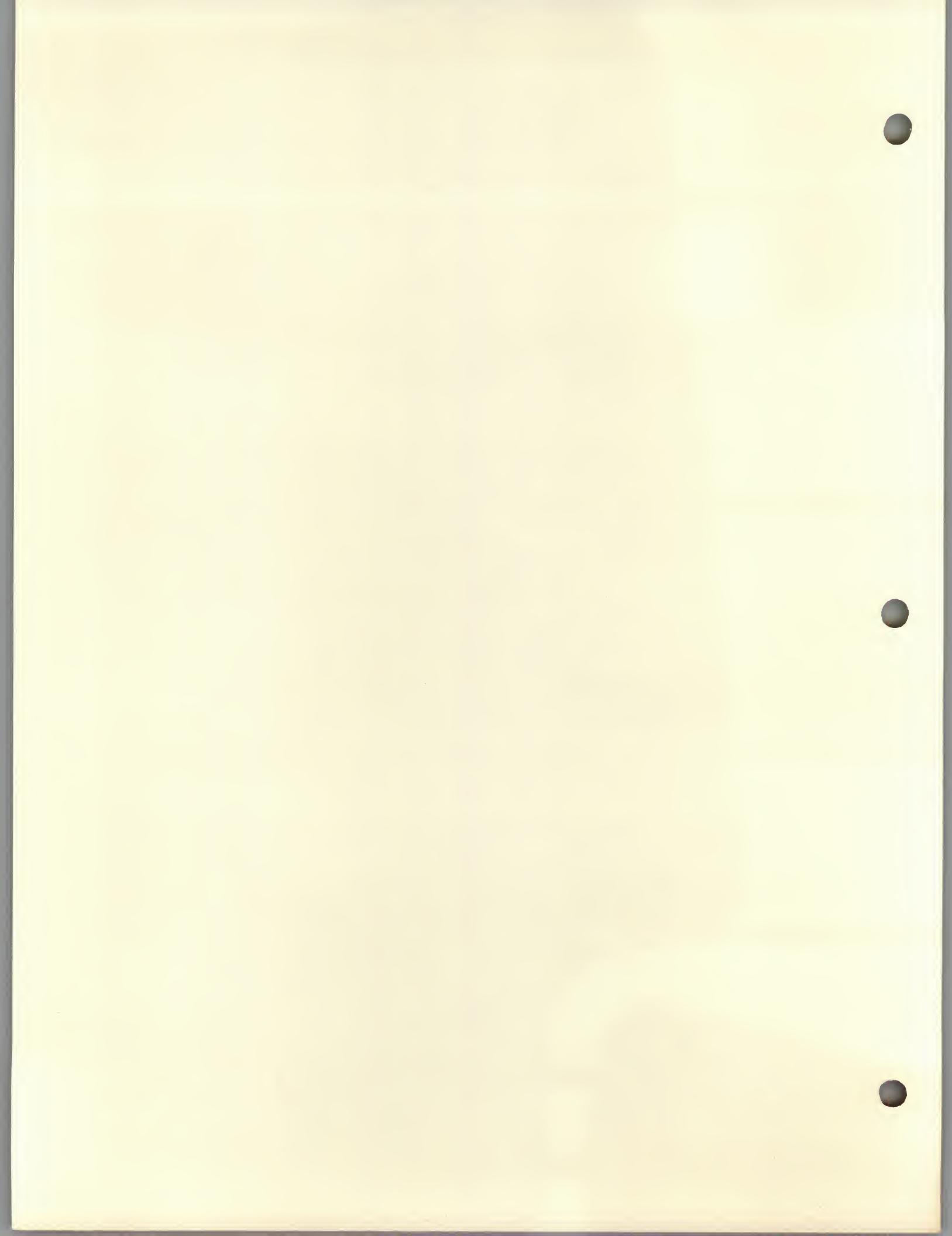
1. Turn the power switch to the on (1) position (Figure 6-3). The terminal automatically runs the power-up self-test. The test provides the following indications.
 - a. The screen displays test data, the wait message, and then is erased. (The test data and wait message are not visible when the terminal is not warmed up.)
 - b. All keyboard indicators turn on and off, and either the ON LINE or OFF LINE indicator turns on.
 - c. A bell tone sounds.
 - d. The cursor is displayed in the upper-left corner of the screen.

Any error found by the power-up self-test is indicated by: the terminal not performing the above sequence, a character displayed at the cursor position, keyboard indicators L1 through L4, or several bell tones. If a failure is indicated, refer to Chapter 8 for more information about self-test and self-test failures.

2. If the terminal powers up correctly, select the desired SET-UP features as described in Chapter 2.
3. When the SET-UP features are selected, record the selections on the SET-UP label attached to the keyboard.
4. Save the SET-UP features using the **SHIFT** and **S** key sequence. Refer to Chapter 2 for more information about saving SET-UP features.



Options



7 OPTIONS

GENERAL

The terminal has only one internally installed option, the 20 mA current loop interface (VT1XX-CA). This chapter describes the option, its installation, and checkout. Refer to Chapter 9 for ordering information.

20 mA CURRENT LOOP INTERFACE OPTION (VT1XX-CA)

This option is an interface that connects the terminal to a computer. The 20 mA option is a board and interface connector. Figure 7-1 shows the 20 mA current loop interface connector and pin assignments.

NOTE: The terminal uses either the 20 mA or standard modem interface. When the standard modem interface is used with a 20 mA option installed, unplug the cable connecting the 20 mA option board to the terminal controller board.

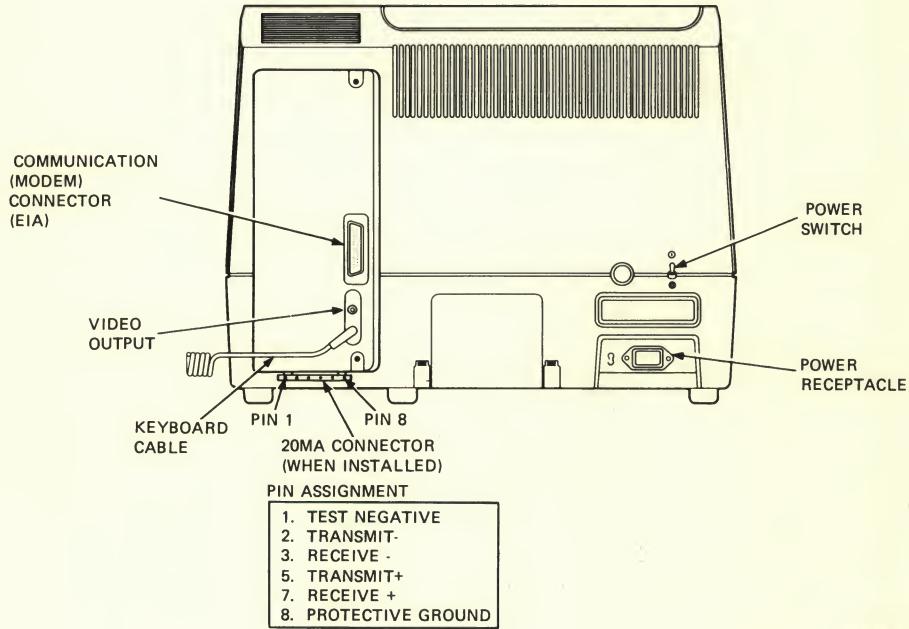


Figure 7-1 20 mA Connector and Pin Locations

INSTALLATION

Use the following procedure to install the option.

1. Turn the power switch to the off (0) position (Figure 7-1).
2. Unplug the power cord, keyboard, and any cables to the composite video output connector.
3. Unplug the communication cable.
4. Loosen the two captive screws holding the access cover in place (Figure 7-2).
5. Pull the access cover straight out from the back of the terminal. When the access cover is loose, move it to the left to avoid the studs in the terminal. Then continue to pull the access cover straight out (Figure 7-3).
6. Install the 20 mA option board onto the access cover. Use the three Phillips screws provided (Figure 7-4).
7. Install the 20 mA connector on the bottom of the access cover. Use the two spacers and two hexhead screws provided.

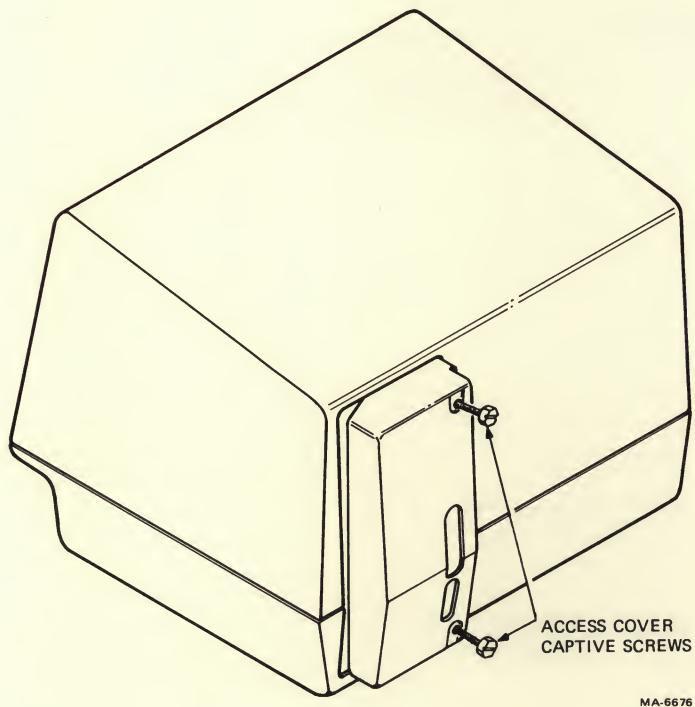


Figure 7-2 Access Cover Screw Locations

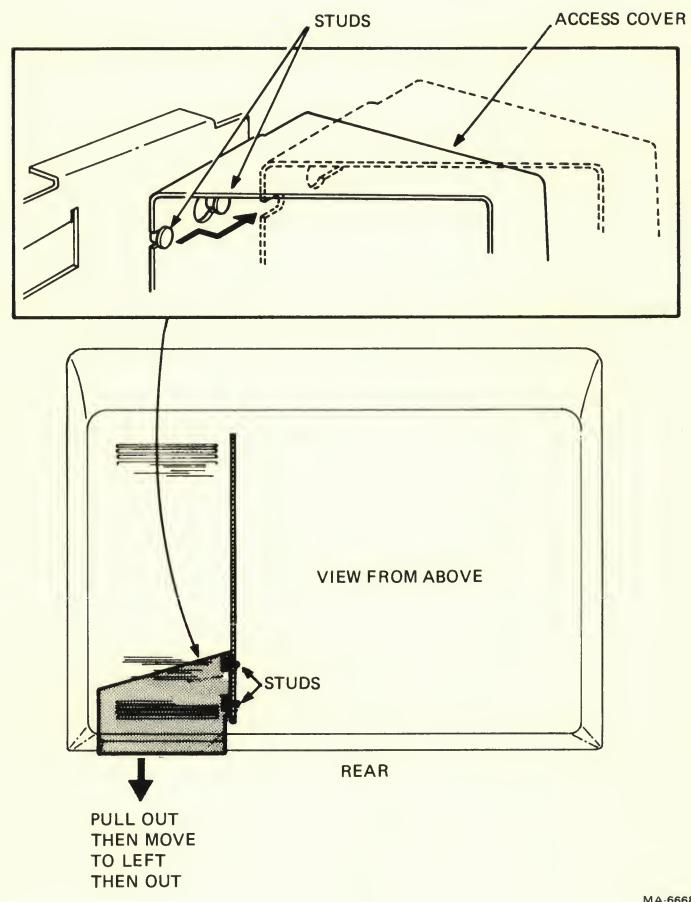


Figure 7-3 Access Cover Removal

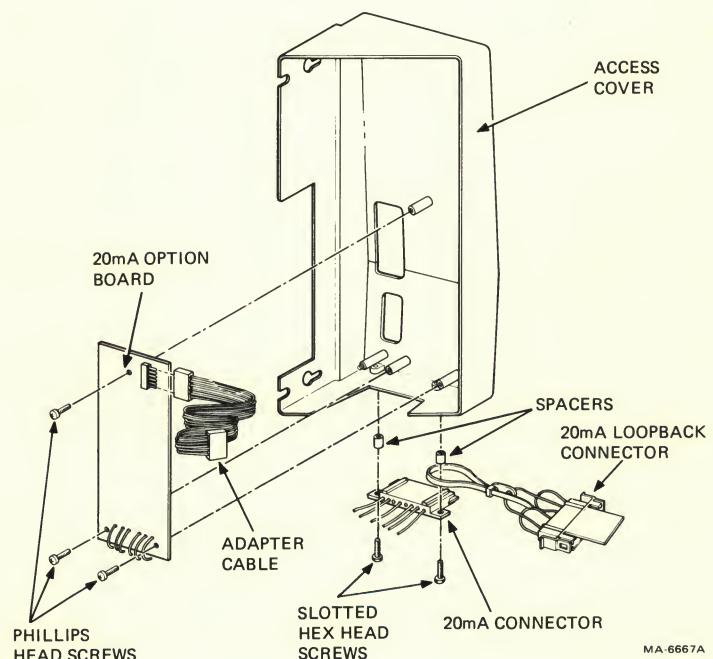


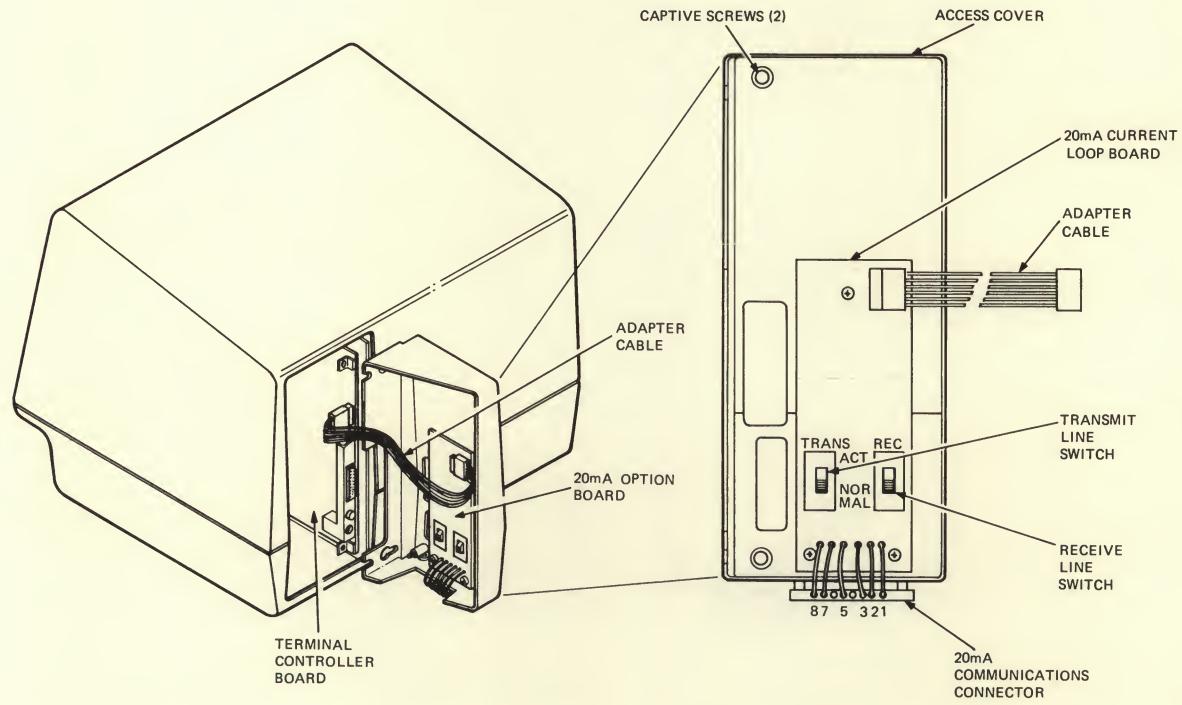
Figure 7-4 20 mA Board Installation

8. Install the 20 mA loopback connector to a spacer holding the 20 mA connector to the access cover. This is done to prevent the loss of the loopback connector.
9. Set the transmit and receive switches to the proper configuration (Figure 7-5).

The switches determine if the transmitter and receiver of the 20 mA interface are active or normal (passive). Usually, the terminal is connected using normal (passive). Passive means that the terminal does not supply the 20 mA current used during communication. Active means that the terminal supplies the 20 mA current used during communication.

NOTE: These switches must be set for normal (passive) operation to perform the loopback self-test. The test verifies correct operation of the option after installation.

10. Connect the adapter cable (provided with the option) to the 20 mA board (Figure 7-5). Place the access cover next to the opening in the back of the terminal. Connect the other end of the cable to the connector on the terminal controller board.



MA-6666

Figure 7-5 20 mA Board Configuration

11. Hold the access cover straight up and move it to the right side of the opening in the terminal. Push the access cover into the back of the terminal and feel the studs in the terminal. Push the access cover onto the studs until the cover is in place. Figure 7-3 shows how the access cover fits on the studs.
12. Tighten the two captive screws to hold the access cover in place (Figure 7-2).

CAUTION: The access cover may be damaged if the captive screws are tightened too much.

13. Perform the option checkout procedure.

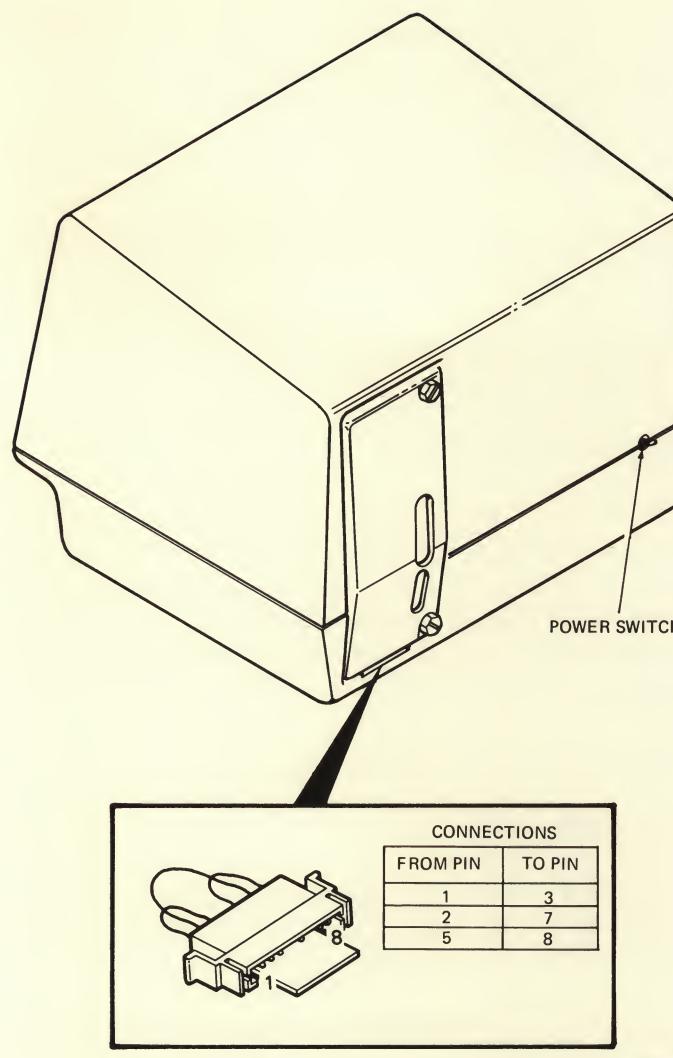
OPTION CHECKOUT

The data loopback self-test verifies the correct operation of the 20 mA option. In the test, the transmit and receive lines are connected to each other using the 20 mA loopback connector. The terminal transmits and receives characters during the test. Use the following procedure to perform the data loopback self-test.

1. Turn the power switch to the off (0) position.
2. Unplug the communication cable.
3. Install the 20 mA loopback connector (Figure 7-6). The 20 mA loopback connector (DIGITAL PN 70-15503-00) is supplied with the option.
4. Remove the access cover and select the 20 mA switches. Use the following procedure to remove and select the switches.

NOTE: The access cover is only removed if the transmit and receive switches of the 20 mA option are not set to normal.

- a. Unplug the power cord, keyboard, and composite video output cables.
- b. Loosen the two captive screws holding the access cover in place (Figure 7-2).
- c. Pull the access cover straight out from the back of the terminal. When it is loose, move the access cover to the left to avoid the studs in the terminal. Then continue to pull the access cover straight out (Figure 7-3).



MA-7867

Figure 7-6 20 mA Loopback Connector

- d. Set both 20 mA option switches to the normal position (Figure 7-5) and install the access cover (Figure 7-3).

CAUTION: The access cover can be damaged if the captive screws are tightened too much.

- e. Connect the power cord and keyboard cable.
5. Turn the power switch to the on (1) position. The terminal performs the power-up self-test.

6. Enter SET-UP and select:

- a. Off-line (the transmit and receive speeds do not have to be the same).
- b. ANSI/VT52 SET-UP feature to ANSI (SET-UP B switch 2-3 = 1).

7. Start the data loopback self-test by using one of the following sequences.

ESC [2 ; 2 y Performs data loopback self-test once

ESC [2 ; 10 y Performs data loopback self-test continuously

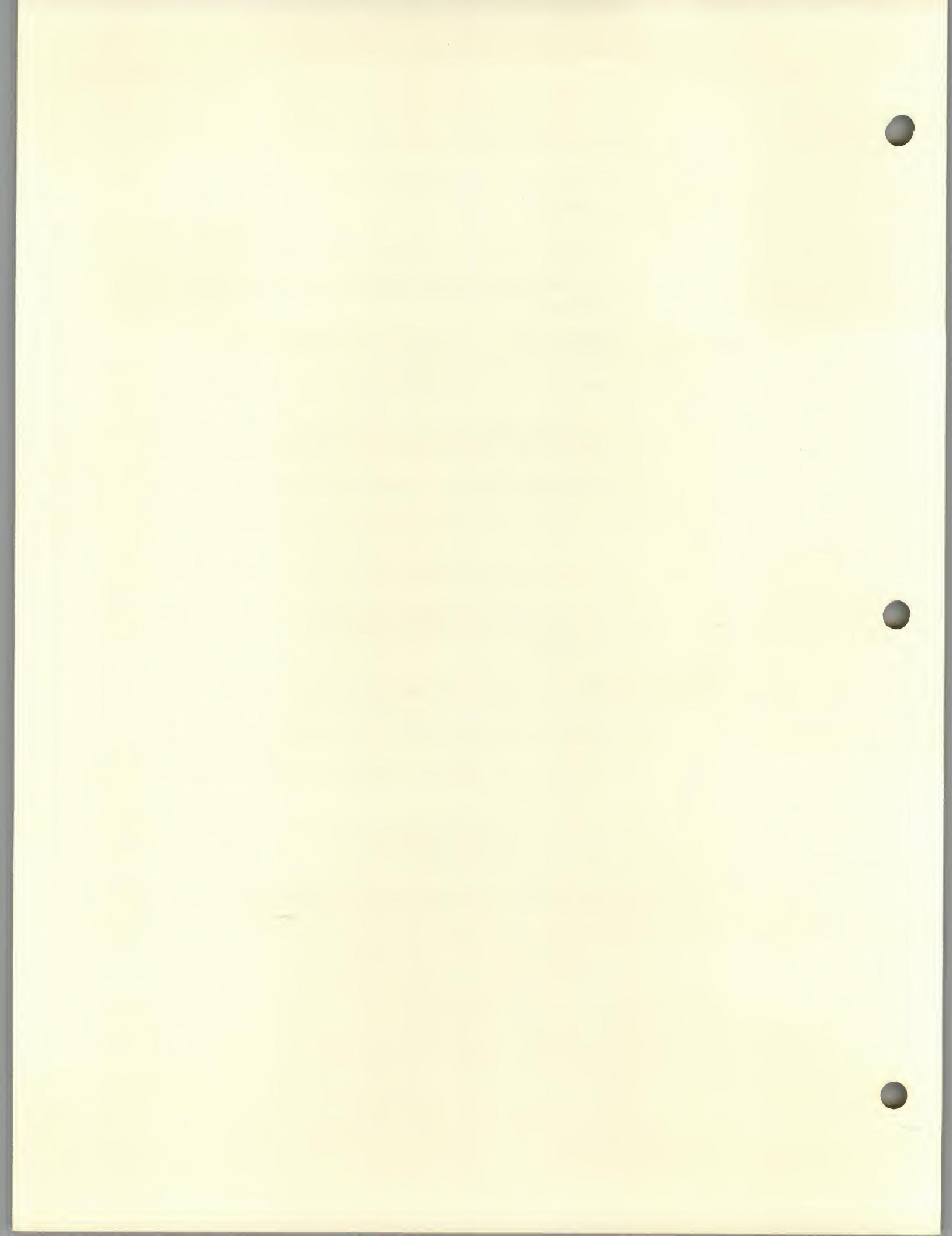
The single data loopback test displays the wait message while running the test. The test ends with the following indications.

- a. The wait message is erased from the screen.
- b. Either the ON LINE or OFF LINE indicator is on.
- c. The cursor is displayed in the upper-left corner of the screen.

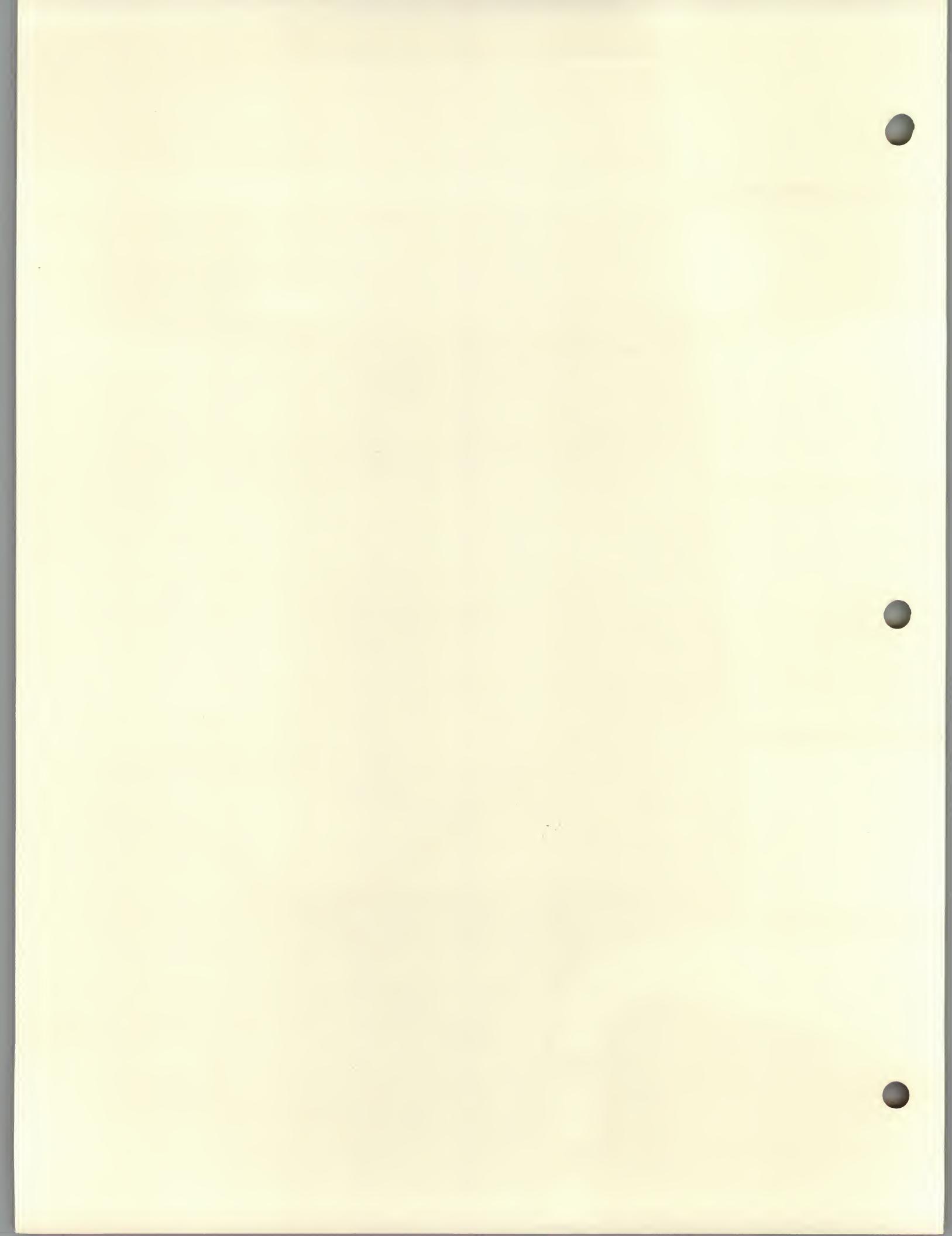
The continuous loopback test displays the wait message while running the test. The test ends only when *an error is found or power is turned off*.

Any error found by the data loopback self-test displays an error code on the screen. If an error is found, the option is not operating correctly. Call your local DIGITAL Field Service Office for help.

8. Turn the power switch to the off (0) position and remove the loopback connector.
9. If the 20 mA switches were changed to perform the self-test, select the correct option switch positions.
10. Connect the communication and composite video output cables.



Maintenance and Troubleshooting



MAINTENANCE AND TROUBLESHOOTING

8

GENERAL

This chapter describes maintenance procedures, troubleshooting (what to do in the event of a problem) and self-tests used with the terminal. Troubleshooting should be performed before requesting service.

MAINTENANCE

The terminal needs no preventive maintenance. However, the surfaces may be cleaned with any mild detergent that does not use solvents. To clean the surfaces of the terminal or screen, apply the detergent to a cloth or tissue and then clean. To clean the keys, rub with a dry or moist cloth.

CAUTION: Do not use too much detergent when cleaning the terminal. If liquids get inside the terminal, they can cause damage. Do not remove the keycaps when cleaning. The keyswitch contacts can be damaged if the keycaps are replaced incorrectly.

TROUBLESHOOTING

If the terminal is not operating correctly, first refer to Table 8-1 to see if the symptoms are listed there. Use the following procedure if the problem is not listed.

1. Turn the power switch to the off (0) position and check the following.
 - a. Power cord - Make sure the cord is connected securely at both the terminal and the wall outlet. Check the wall outlet with another device, such as a lamp, to be sure that it is providing ac power.
 - b. Voltage selection switch and fuse - Make sure the switch is in the correct position. To use the terminal with 120 volts, perform the following steps.
 - (1) Unplug the ac power cord.
 - (2) Set the voltage selection switch to 115* (operating range 99-128 volts).

*On some terminals the voltage selection switch reads 100 (operating range 87-107).

Table 8-1 Problem Checklist

Symptom	Possible Cause	Corrective Action
ON LINE or OFF LINE is on with no cursor on screen.	Screen brightness is too low.	Enter SET-UP and increase screen brightness.
ON LINE or OFF LINE is not on with no keyboard response. Cursor is on screen.	Keyboard cable is not connected to terminal.	Turn off terminal and connect keyboard cable.
KBD LOCKED is on.	Keyboard buffer is full, keyboard cannot accept more characters, terminal received XOFF.	Entering and exiting SET-UP clears this condition. Be careful that characters are not lost during this procedure.
Terminal does not respond to typed characters. Keyclicks generated and keyboard indicators are on.	Screen cannot be updated by the computer, terminal transmitted XOFF.	Press NO SCROLL . Enter and exit SET-UP.
Wrong characters or substitute (⌘) characters, or no characters appear on the screen.	SET-UP feature selection is incorrect.	Correct the SET-UP features. These SET-UP features may be in error: ANSI/VT52 mode, auto XON/XOFF, data/parity bits, receive parity, receive speed, and transmit speed.
	There is a computer error.	Check computer system.
Two characters appear on screen for each character typed.	Local echo feature is on.	Turn off feature.
Several bell tones sound during power-up, reset, or recall.	There is a read or write problem with user permanent memory.	Check the SET-UP feature settings and try the save operation.

- (3) Remove the fuse holder cap by pressing it in and turning counterclockwise. Make sure the fuse is 1.25 A (DIGITAL PN 9000020-01). Replace the fuse holder cap by pressing it in and turning clockwise.

- (4) Plug in the ac power cord.

To use the terminal with 220-240 volts, perform the following steps.

- (1) Unplug the ac power cord.

- (2) Set the voltage selection switch to 230* V (operating range 198-256 volts).

- (3) Remove the fuse holder cap by pressing it in and turning counterclockwise. Make sure the fuse is a 0.75 A slow blow (DIGITAL PN 1211237-00). Replace the fuse holder cap by pressing it in and turning clockwise.

- (4) Plug in the ac power cord.

- c. Keyboard coiled cord - Check that the cord is securely plugged into the keyboard connector at the back of the terminal.

2. Turn the power switch to the on (1) position. The terminal performs the power-up self-test. (Refer to the power-up self-test description in this chapter for more information.)
3. Perform the data loopback self-test if desired. (Refer to the data loopback self-test description in this chapter for more information.)

SELF-TESTS

The terminal uses self-tests to verify operation: a power-up self-test and a data loopback self-test. The power-up self-test is performed each time the terminal is powered up. The data loopback self-test may be performed after the power-up self-test is completed. To perform the data loopback self-test, the terminal must be disconnected from the communication line and an external loopback connector must be installed.

*On some terminals the voltage selection switch reads 250 (operating range 222-268).

Power-Up Self-Test

The power-up self-test checks the general terminal operation, user memory (holding SET-UP features), and the keyboard. Use the following procedure to perform the power-up self-test.

1. Start the power-up self-test in any one of the following ways.
 - a. Turn the power switch to the on (1) position.
 - b. If power is on, enter SET-UP and press the **RESET** key.
 - c. If power is on, type one of the following sequences. The terminal is off-line with the ANSI/VT52 SET-UP feature selected to ANSI (SET-UP B switch 2-3 = 1).

ESC [2 ; 1 y Performs data loopback self-test once

ESC [2 ; 9 y Performs data loopback self-test continuously

The single test ends with the following indications.

- a. Test data is displayed, the wait message is displayed and then it is erased. (The test data and wait message are not displayed if the terminal has not warmed up.)
- b. Keyboard indicators flash on and off, and either ON LINE or OFF LINE is on.
- c. A bell tone sounds.
- d. The cursor is displayed in the upper-left corner of the screen.

During the continuous test, test data is displayed, the wait message is displayed, and then it is erased. (The test data and wait message are not displayed if the terminal has not warmed up.)

The continuous test ends only if an error is found or if power is turned off.

Any error found by the power-up self-test is indicated by: a character on the screen, keyboard indicators L1 through L4, or several bell tones.

There are two failures that allow operation of the terminal. They are: a user memory failure (indicated by displaying a 2 and several bell tones, and a keyboard failure (indicated by displaying a 4). The user memory failure allows continued operation after the SET-UP features are selected in operating memory. The keyboard failure allows the terminal to operate as a receive-only terminal.

Data Loopback Self-Test

This test verifies that the terminal can transmit and receive characters. In this test, the transmit and receive lines are connected to each other with an external loopback connector. The terminal transmits characters on the transmit line and receives characters on the receive line. Use the following procedure to perform the data loopback self-test.

NOTE: To perform the data loopback self-test with the 20 mA current loop interface option (VT1XX-CA) installed, refer to Chapter 7.

1. Turn the power switch to the off (0) position (Figure 8-1).
2. Unplug the communication cable and install the loopback connector on the EIA connector (DIGITAL PN 12-15336) (Figure 8-2). The EIA loopback connector is available from the DIGITAL Accessories and Supplies Group (refer to Chapter 9) or can be manufactured locally.
3. Turn the power switch to the on (1) position. The terminal performs the power-up self-test.
4. Type one of the following sequences to perform the test. The terminal is off-line with the ANSI/VT52 SET-UP feature selected to ANSI (SET-UP B switch 2-3 = 1).

ESC [2 ; 2 y Performs data loopback self-test once

ESC [2 ; 10 y Performs data loopback self-test continuously

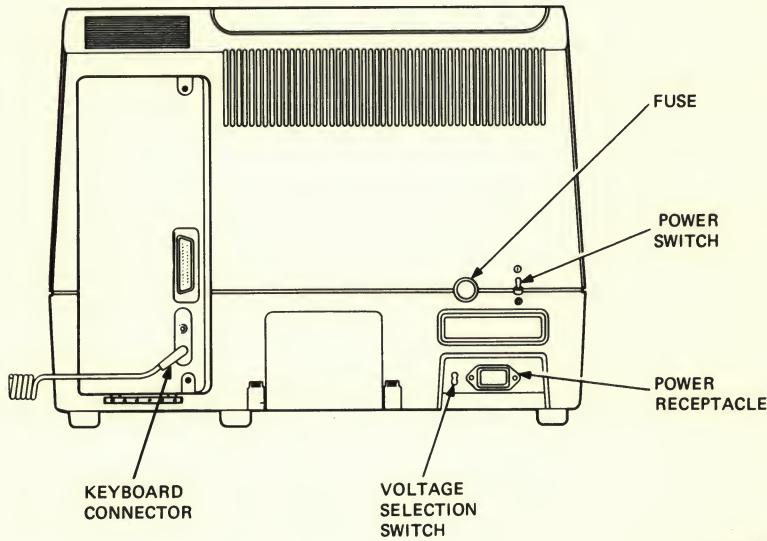


Figure 8-1 Monitor Controls

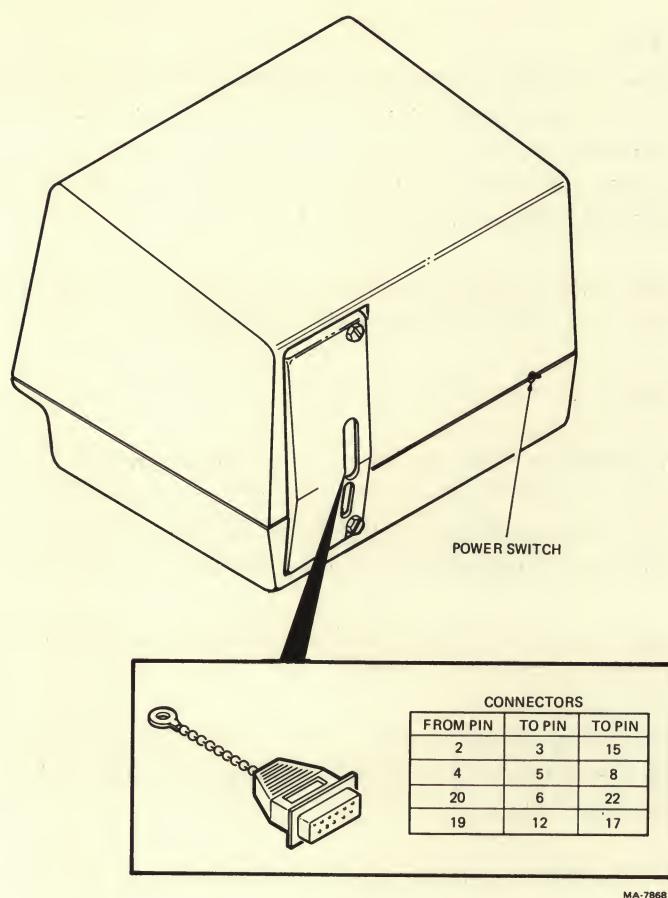


Figure 8-2 EIA Loopback Connector

The single test displays the wait message while running. The test ends with the following indications.

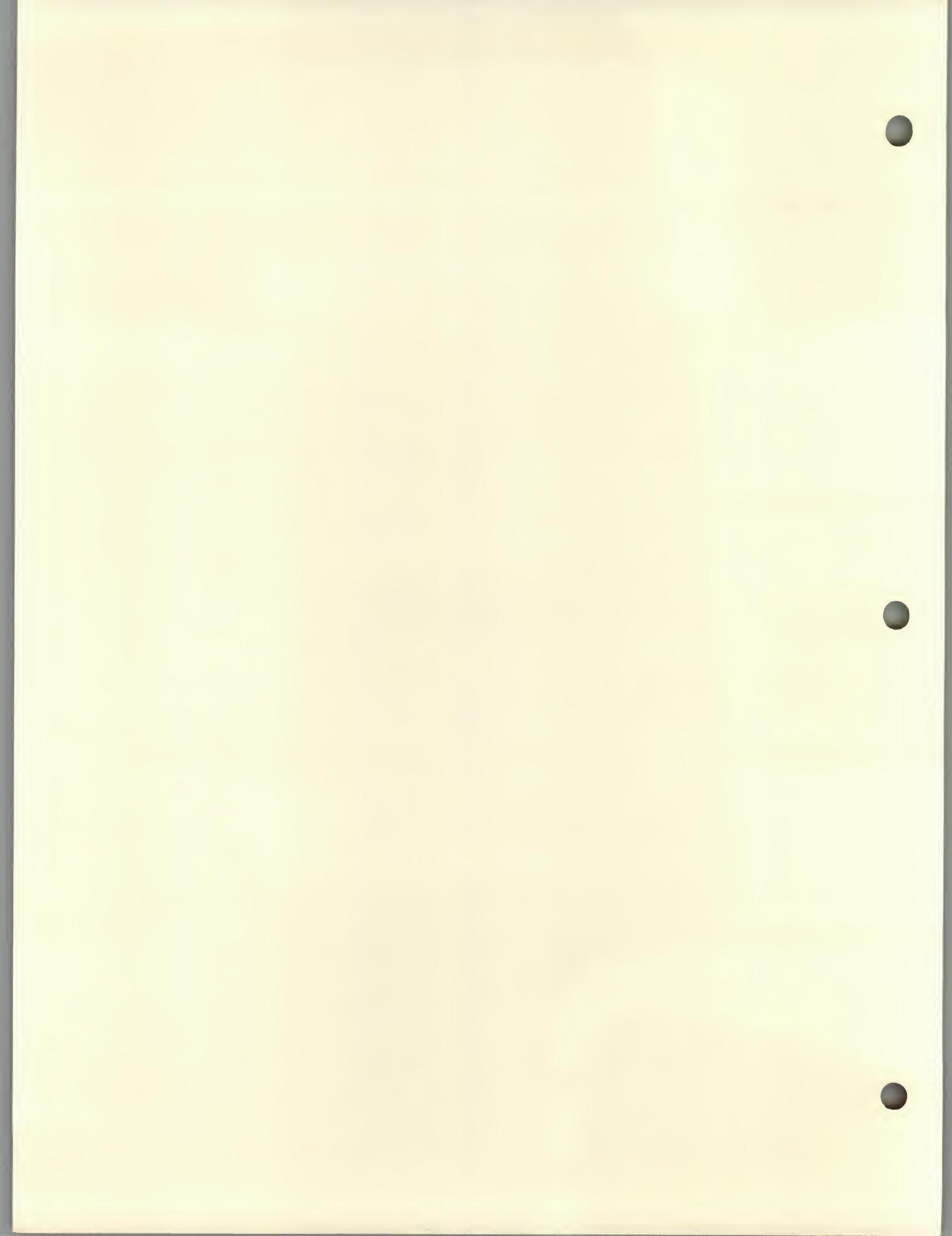
- a. The message is erased.
- b. Either the ON LINE or OFF LINE indicator is on.
- c. The cursor is displayed in the upper-left corner of the screen.

The continuous test displays the wait message while running. The test ends only if an error is found or if power is turned off.

Any error found by the data loopback self-test displays an error code on the screen. Call your local DIGITAL Field Service Office for assistance.

5. Turn the power switch to the off (0) position. Remove the loopback connector and connect the communication cable.

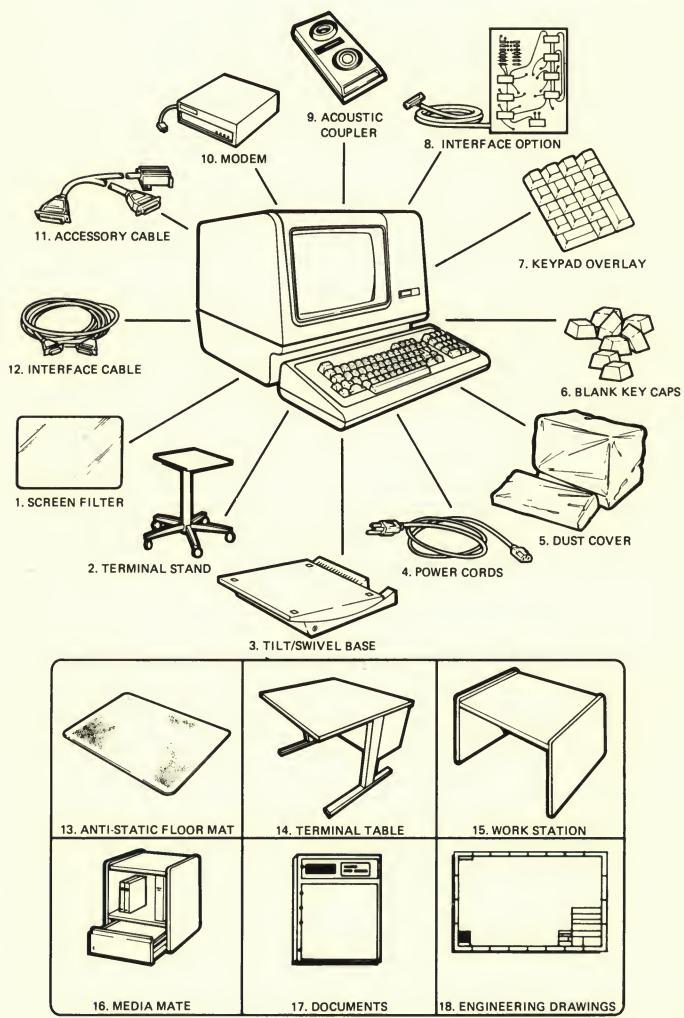
Accessories and Supplies



ACCESSORIES AND SUPPLIES

GENERAL

This chapter describes the accessories and supplies offered by DIGITAL for the VT101. Part numbers and ordering information are included. Item numbers in Figure 9-1 correspond to item numbers in the following list.



MA 8074

Figure 9-1 Accessories and Supplies

ACCESSORIES

Item	Part Number	Description
1	VT1XX-FA	VT101 grey antiglare panel kit
1	VT1XX-FB	VT101 green antiglare panel kit
1	VT1XX-FC	VT101 bronze antiglare panel kit
1	VT1XX-AE	VT101 formed plastic screen filter, grey, antiglare coating
1	VT1XX-AW	VT101 formed plastic screen filter, green (AW), antiglare coating
1	VT1XX-AX	VT101 formed plastic screen filter, yellow (AX), antiglare coating
1	VT1XX-AR	VT101 formed plastic screen filter, amber (AY), antiglare coating
1	VT1XX-AR	VT101 nonreflective filter screen
2	VT1XX-ST	VT101 terminal stand with casters
2	VT1XX-SU	VT101 terminal stand with casters (lots of 25)
2	VT1XX-SV	VT101 terminal stand with casters (lots of 50)
3	VT1XX-SA	VT101 tilt swivel base
4	17-00083-09	United States (120 V)
4	17-00083-10	United States (220-240 V)
4	17-00209-00	United Kingdom
4	17-00199-00	Continental Europe (SCHUKO)
4	17-00210-00	Switzerland
4	17-00198-00	Australia
4	17-00310-00	Denmark
4	90-00020-01	1.25 amp fuse (115 or 100 Vac)
4	12-11237-00	0.75 amp slow blow fuse (230 or 250 Vac)
5	H9850-HK	Heavy gauge vinyl dust cover, charcoal brown (2 cover set)

Item	Part Number	Description
6	LA12X-UB	Blank keycap kit of 50, Row 1*
6	LA12X-UC	Blank keycap kit of 50, Row 2
6	LA12X-UR	Blank keycap kit of 50, Row 3
6	LA12X-UA	Blank keycap kit of 50, Row 4
6	LA12X-US	Blank keycap kit of 50, Row 5
6	LA12X-UD	Blank keycap kit of 50, F&J type
6	LA12X-UE	Blank keycap kit of 50, SET-UP
6	LA12X-UF	Blank keycap kit of 50, TAB
6	LA12X-UH	Blank keycap kit of 50, CAPS LOCK
6	LA12X-UJ	Blank keycap kit of 50, SHIFT
6	LA12X-UL	Main array blank keycap set
6	LA12X-UM	Blank keycap kit of 50, CR
6	LA12X-UN	Blank keycap kit of 50, ENTER
6	LA12X-UP	Blank keycap kit of 50, Num Pad 0
6	LA12X-UT	Numeric pad blank keycap set
7	VT1XX-KA	KED/EDT keypad overlay
7	VT1XX-KB	FMS-FED (form editor) keypad overlay
7	VT1XX-KC	FMS-FDV (form driver) keypad overlay
8	VT1XX-CA	VT101 20 mA current loop interface option with BC05F-15 cable
9	DF01-A	Acoustic telephone coupler, 300 baud
10	DF02-AA	Direct connect, Bell 103J equivalent, 300 baud full-duplex modem with EIA RS-232-C interface
10	DF03-AA	Bell 212A equivalent, 300 / 1200 baud full-duplex with EIA RE-232-C interface

*Row 1 is the first row above the space bar.

Item	Part Number	Description
11	30-10958-02	Cable interface DF01-A couplers to VT101 terminals
12	BC22A-10	EIA RS-232 female-female null modem cable shielded 3.0 m (10 ft)
12	BC22A-25	EIA RS-232 female-female null modem cable shielded 7.6 m (25 ft)
12	BC22B-10	EIA RS-232 male-female extension cable shielded 3.0 m (10 ft)
12	BC22B-25	EIA RS-232 male-female extension cable shielded 7.6 m (25 ft)
12	BC23A-10	Kit of 5 BC22A-10
12	BC23A-25	Kit of 5 BC22A-25
12	BC23B-10	Kit of 5 BC22B-10
12	BC23B-25	KIT OF 5 BC22B-25

NOTE: EIA RS-232-C specifies a maximum cable length of 15 m (50 ft). EIA RS-423 specifies a maximum cable length of 61 m (200 ft).

12	BC03M-AO	Female-female null modem cable 30.5 m (100 ft)
12	BC03M-B5	Female-female null modem cable 76.2 m (200 ft)
12	BC03M-EO	Female-female null modem cable 152.4 m (500 ft)
12	BC03M-LO	Female-female null modem cable 304.8 m (1000 ft)
12	BC05X-15	20 mA current loop extension cable 4.6 m (15 ft)
12	BC05X-25	20 mA current loop extension cable 7.6 m (25 ft)
12	BC05X-50	20 mA current loop extension cable 15.2 m (50 ft)

Item	Part Number	Description
13	H9850-DA	Antistatic floor mat, DECmat, 122 cm × 183 cm (4 ft × 6 ft), driftwood color (brownish grey)
13	H9850-DB	Antistatic floor mat, DECmat, 122 cm × 183 cm (4 ft × 6 ft), summer earth color (brown/gold)
13	H9850-DC	Antistatic floor mat, DECmat, 91 cm × 305 cm (3 ft × 10 ft), silver birch color (silverygrey/brown)
13	H9850-DD	Antistatic floor mat, DECmat, 91 cm × 305 cm (3 ft × 10 ft), autumn bronze color (orange/brown)
13	H9850-DE	Antistatic floor mat, DECmat, 91 cm × 305 cm (3 ft × 10 ft), driftwood color (brownish grey)
13	H9850-DF	Antistatic floor mat, DECmat, 122 cm × 183 cm (4 ft × 6 ft), silver birch color (silverygrey/brown)
13	H9850-DH	Antistatic floor mat, DECmat, 122 cm × 183 cm (4 ft × 6 ft), autumn bronze color (orange/brown)
14	H970-EB	Terminal table, 68.6 cm high × 91.4 cm wide × 76.2 cm deep (27 in × 36 in × 30 in), with levelers
14	H970-HB	Terminal table, 68.6 cm high × 61.0 cm wide × 76.2 cm deep (27 in × 24 in × 30 in), with levelers
15	H9532-AA	Workstation with blue front panel and grey side panels, levelers, 122 cm wide × 76.2 cm high × 76.2 cm deep (48 in × 30 in × 30 in)
15	H9532-AB	Workstation with brown front panel and brown side panels, levelers, 122 cm wide × 76.2 cm high × 76.2 cm deep (48 in × 30 in × 30 in)
16	H9850-AP	Media mate, file or shelf storage cart with casters and locking drawer, 64.1 cm high × 38.1 cm deep × 47.0 cm wide (25.25 in × 15 in × 18.5 in)

RELATED DIGITAL DOCUMENTATION

Item	Document Number	Description
17	EK-VT101-UG	<i>VT101 User Guide</i> This document describes the installation, operation, and programming of the VT101 and is shipped with the terminal.
17	EK-VT101-PS	<i>VT101 Series Pocket Service Guide</i> This document describes procedures used to troubleshoot and repair the VT101 to the field replaceable unit.
17	EK-VT101-TM	<i>VT101 Series Technical Manual</i> This document describes VT101 to a detailed block level. It provides troubleshooting information for the terminal. This document does not contain detailed schematic drawings. The <i>VT101 Family Field Maintenance Print Set</i> has detailed schematic drawings and is ordered separately.
17	EK-VT101-IP	<i>VT101 Video Terminal IPB</i> This document provides a detailed parts breakdown of the VT101 field replaceable units. This document does not contain part numbers for components on the printed circuit boards. However, components are listed in the <i>VT101 Family Field Maintenance Print Set</i> and is ordered separately.
17	EK-VT101-RC	<i>VT101 Terminal Programming Reference Card</i> This document provides a summary of the VT101 escape and control sequences on a pocket-size reference card.
18	MP-01066	<i>VT101 Family Field Maintenance Print Set</i> This document provides a complete set of electrical and mechanical schematic diagrams for the VT101.

ALIGNMENT TEMPLATES

Part Number	Description
94-03220-3	Screen alignment template
94-03246-3A	Character width template
94-03246-3B	Character height template

DATA LOOPBACK TEST CONNECTORS

12-15336-00	EIA loopback connector
70-15503-00	Current loop connector

SPARES KIT

4A-VT101-00	VT101 spares kit
-------------	------------------

ORDERING INFORMATION**Continental USA**

Call 800-258-1710 or mail order to:

Digital Equipment Corporation
PO Box CS2008
Nashua, NH 03061.

New Hampshire

Call 603-884-6660 or mail order to:

Digital Equipment Corporation
PO Box CS2008
Nashua, NH 03061.

Alaska or Hawaii

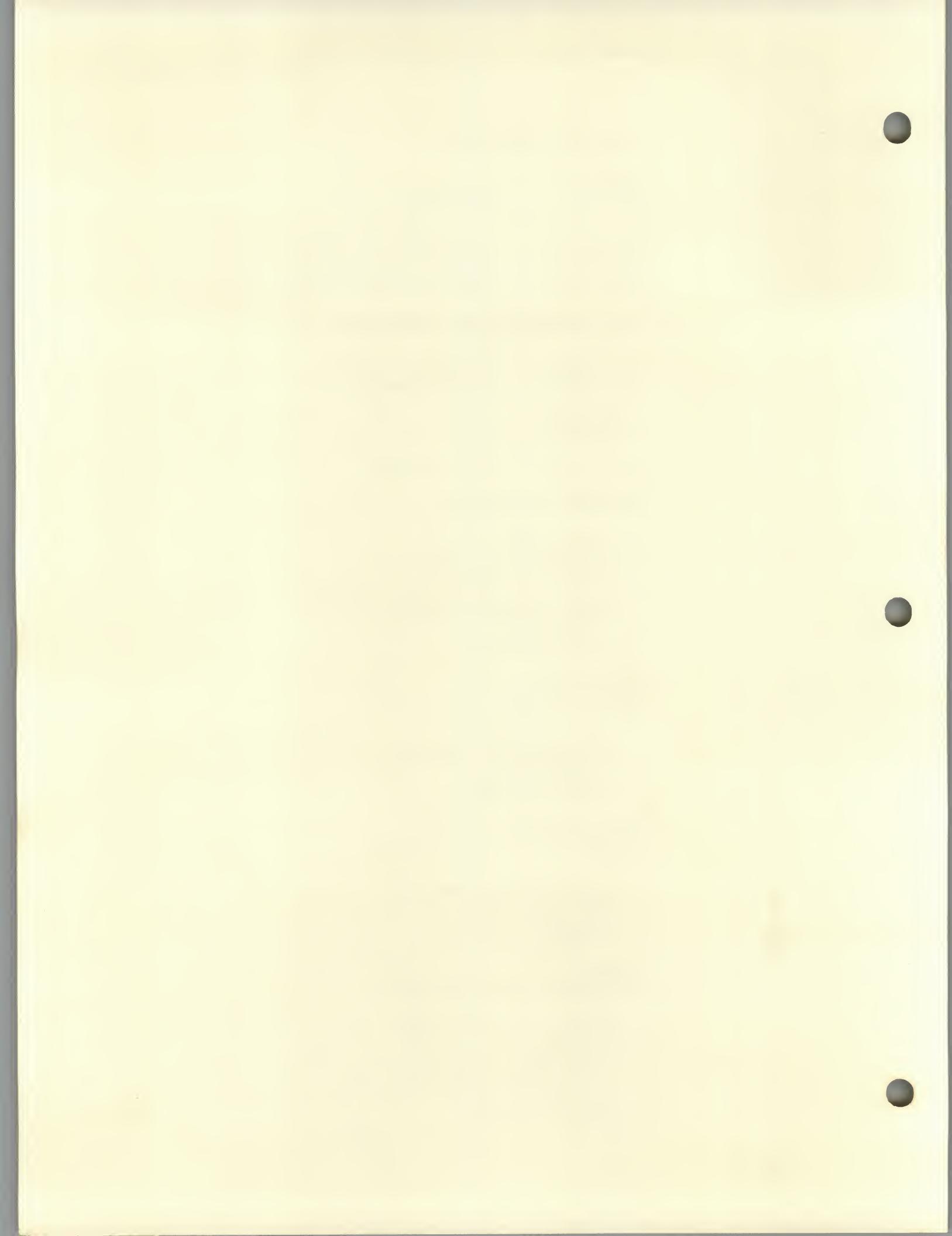
Call 408-734-4915 or mail order to:

Digital Equipment Corporation
632 Caribbean Drive
Sunnyvale, CA 94086.

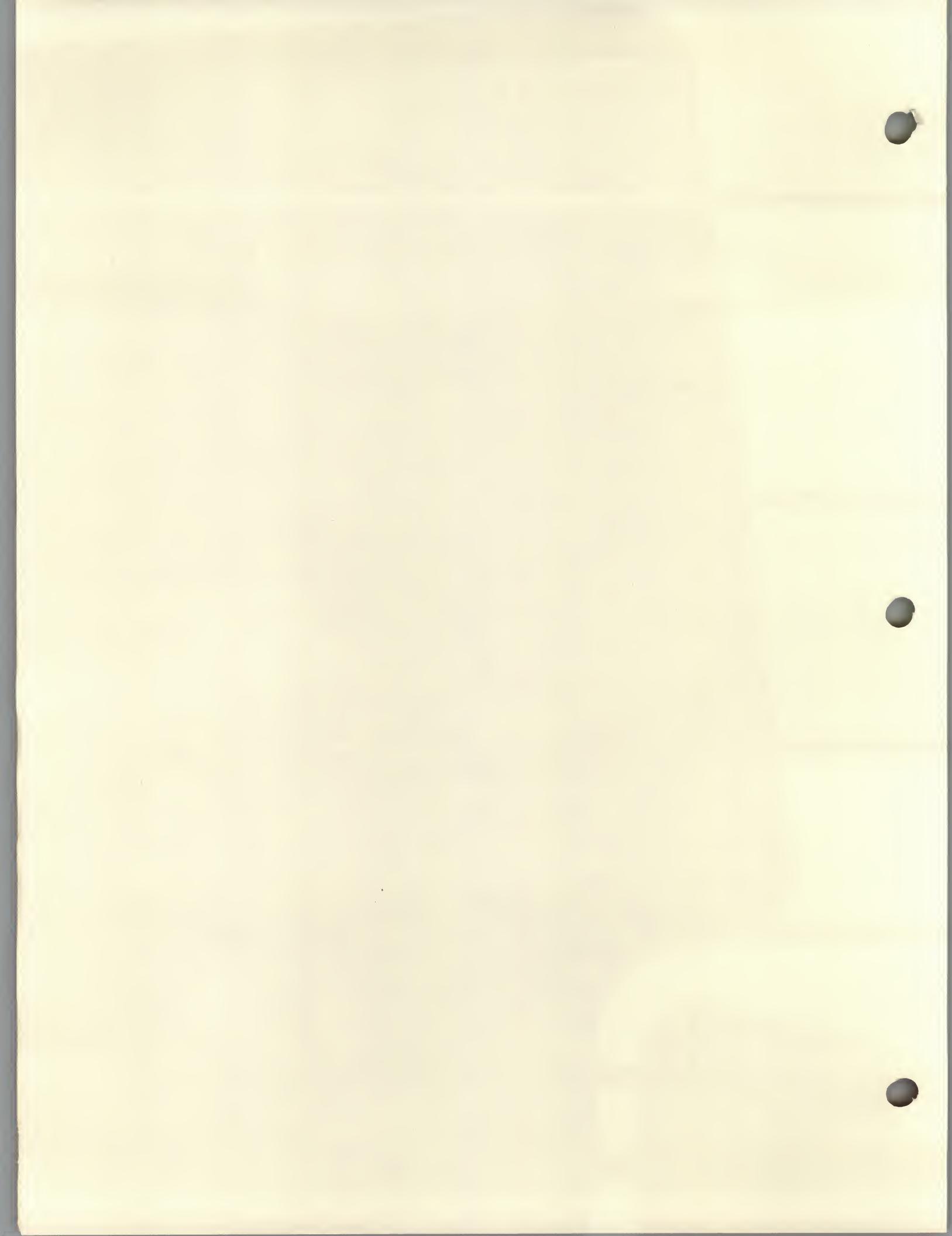
Canada

Call 800-267-6146 or mail order to:

Digital Equipment Corporation
PO Box 13000
Kanata, Ontario Canada K2K 2A6
Att: A&SG Business Manager
Telex: 610-562-8732.



Appendices



SPECIFICATIONS



GENERAL

This appendix lists the specifications of the VT101 and provides X-ray emission statements, loopback connector wiring, and related documentation not provided by DIGITAL.

SPECIFICATIONS

Dimensions

Monitor

Height	36.83 cm (14.5 in)
Width	45.72 cm (18 in)
Depth	36.20 cm (14.25 in)

Keyboard

Height	8.89 cm (3.5 in)
Width	45.72 cm (18 in)
Depth	20.32 cm (8 in)
Minimum table depth	51.4 cm (20.25 in)

Weight

Monitor	13.6 kg (30 lbs)
Keyboard	2.0 kg (4.5 lbs)
Shipping weight	18.6 kg (41 lbs)

Environmental

Operating

Temperature	10° C to 40° C (50° F to 104° F)
Relative humidity	10 to 90 percent
Maximum wet bulb	28° C (82° F)
Minimum dew point	2° C (36° F)
Altitude	2.4 km (8000 ft)

Nonoperating

Temperature	-40° C to 66° C (-40° F to 151° F)
Relative humidity	0 to 95 percent
Altitude	9.1 km (30000 ft)

Power

Line voltage	99 V-128 V rms (115 V setting) 198 V-256 V rms (230 V setting) 87 to 107 V rms (100 V setting) 222 to 268 V rms (250 V setting) single-phase grounded, 3-wire
Line frequency	47 Hz-63 Hz
Current	0.70 A rms maximum at 120 V rms 0.40 A rms maximum at 240 V rms
Input power	70 W rms or 85 VA apparent
Current limiting	1.25 A fuse (120 V) 0.75 A slow blow fuse (220-240 V)
Power cord	Detachable, 3-conductor grounded
Power cord receptacle	EIA specified CEE22-6A
Display	
CRT	12 inch diagonal measure, P4 phosphor
Format	24 lines \times 80 characters or 14 lines \times 132 characters (selected from keyboard or computer)
Character	7 \times 10 dot matrix with descenders
Character size	80-column mode 3.35 mm \times 2.0 mm (0.132 in \times 0.078 in) 132-column mode 3.35 mm \times 1.3 mm (0.132 in \times 0.051 in)
Active display size	203 mm \times 117 mm (8 in \times 5 in)
Character set	ASCII and UK displays 94 characters (with upper- and lowercase, numeric, and punctuation), 32-character special graphics set
Cursor type	Blinking block character or blinking underline (selected from keyboard)

Keyboard	
General	83-key detachable unit with 1.9 m (6 ft) coiled cord attached
Key layout	65 keys arranged similar to standard typewriter with 18-key numeric keypad
Auxiliary keypad	18 keys with period, comma, minus, enter, and 4 general purpose function keys
Visual indicators	Seven: ON LINE, OFF LINE, KBD LOCKED, and four programmable
Audible indicators	Audible keyclick for each keystroke (selected from keyboard)
	Bell sounds when BEL character received, or sounds eight characters from right margin (selected from keyboard)
	Multiple bell sounds on error in SET-UP save or recall operation
Communication	
Type	Full-duplex EIA
Speeds	50, 75, 110 (two stop bits), 134.5, 150, 200, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 9600, 19,200 baud (selected from keyboard)
Code	ASCII (ISO 646 and CCITT Alphabet 5)
Character format	Asynchronous
Character size	7 or 8 bits (selected from keyboard)
Parity	Even, odd, mark, space, or none (selected from keyboard)
Buffer overflow prevention	Automatic generation of XON and XOFF control codes (selected from keyboard)
Echo	Local echo available (selected from keyboard)

Composite Video Output (J9)

Provides RS170 output with the following nominal characteristics (Figure A-1).

Output impedance = 75 ohms, dc coupled

Sync level = 0 V

Black level = approximately 0.3 V when loaded with 75 ohms

White level = approximately 1.0 V with a 75 ohm load

Composite sync waveform meets EIA RS170 standards.

Vertical interval is six equalizing pulses, six vertical sync pulses, and six more equalizing pulses. Timing is as follows.

Equalizing pulse width	$2.33 \mu s \pm 50 \text{ ns}$
Vertical pulse width	$27.28 \mu s \pm 200 \text{ ns}$
Horizontal pulse width	$4.71 \mu s \pm 50 \text{ ns}$
Horizontal blank width	$11.84 \mu s \pm 50 \text{ ns}$ / 80-column mode $12.34 \mu s \pm 50 \text{ ns}$ / 132-column mode
Front porch	$1.54 \mu s \pm 50 \text{ ns}$

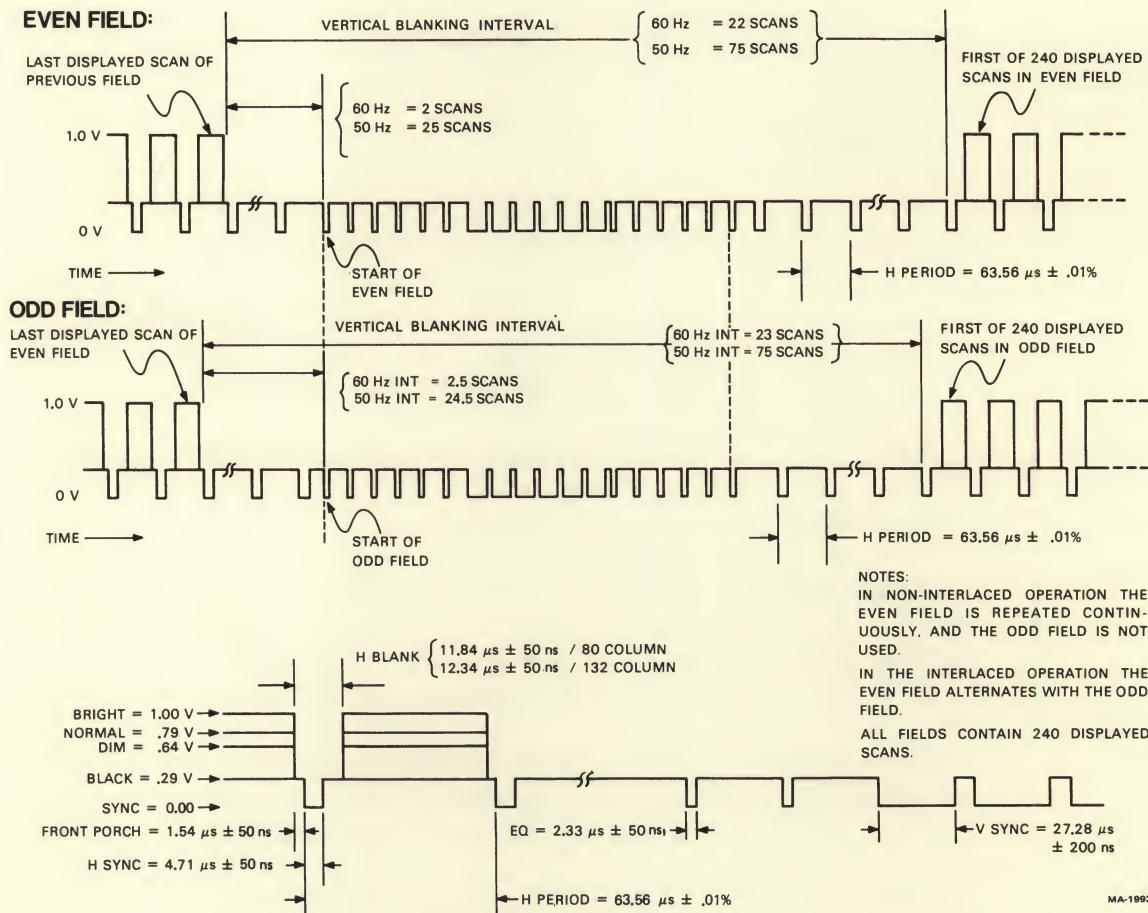


Figure A-1 Composite Video Output

FCC Notice

This equipment generates and uses radio frequency energy. It has been type tested and found to comply with limits for a Class B computing device in accordance with the specifications in Subset J of Part 15 of FCC rules, which are designed to provide reasonable protection against radio and television interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, the user is encouraged to try to correct the interference.

VDE Notice

RFI-suppressed according to German regulation 529/1970 and 227/1976 (VDE 0871 Class B).

X-Ray Emission Data

Rated anode voltage	12 kV (fixed)
Dose rate	Less than 1.43 pA/kg (20 μ R/h)*
Compliance with	Paragraph 5, clause 2 of German X-Ray ordinance (1973)
	CSA 22.2 number 154-1975
	Paragraph 4.1.4
	VDE 0804/5.72, Paragraph 23
	VDE 0730 part 2P/6.76, Paragraph 33
	VDE 0860 part 1/11.76, Paragraph 6
	IEC 65 public 1/1972, Paragraph 6
	CSA number 65
	UL 478
	ECMA 57
Workstation exposure	Does not expose operator to dangerous X-ray radiation

LOOPBACK CONNECTOR WIRING**EIA 20 mA**

From	To	From	To
Pin 2	Pins 3 and 15	Pin 1	Pin 3
Pin 4	Pins 5 and 8	Pin 2	Pin 7
Pin 20	Pins 6 and 22	Pin 5	Pin 8
Pin 19	Pins 12 and 17		

*Measured at a distance of 5 cm (1.96 in) at any accessible point from outer surface.

RELATED DOCUMENTATION

ANSI specifications can be ordered at the following address.

Sales Department
American National Standards Institute
1430 Broadway
New York, NY 10018

EIA specifications can be ordered at the following address.

Electronic Industries Association
Engineering Department
2001 Eye St. NW
Washington, DC 20006

International standards can be ordered at the following address.

CCITT
UN Book Store
United Nations Building
New York, NY 10017

SET-UP SUMMARY

GENERAL

This appendix provides a summary of the VT101 SET-UP features. Figure B-1 shows the screen displays. Figure B-2 is a summary of the SET-UP B features.

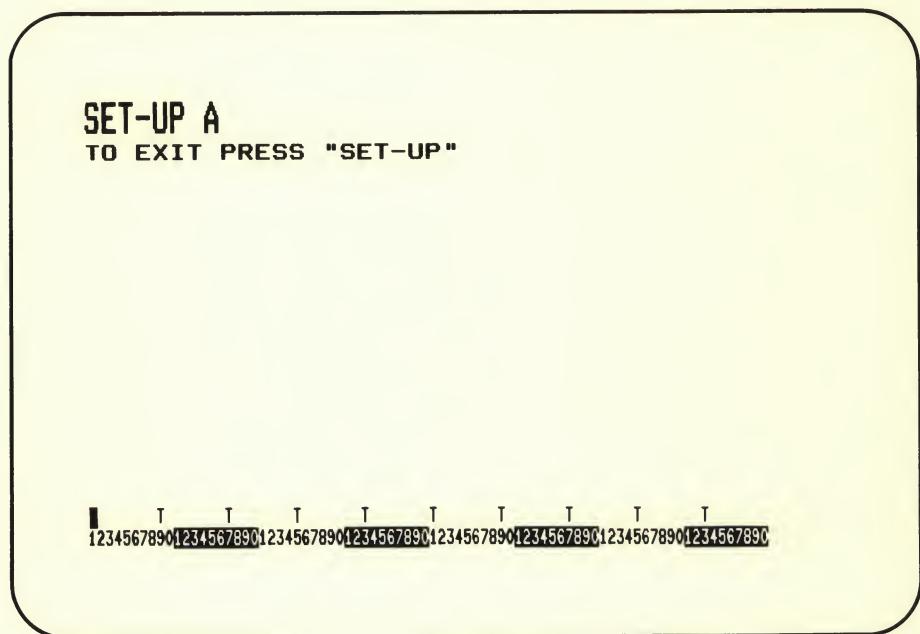


Figure B-1a SET-UP A Screen Display

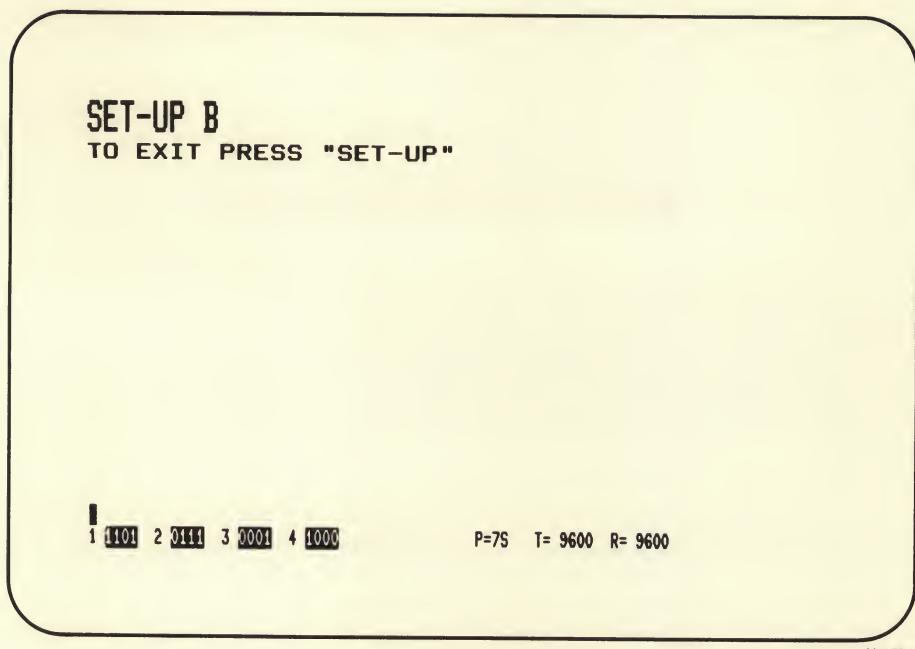


Figure B-1b SET-UP B Screen Display

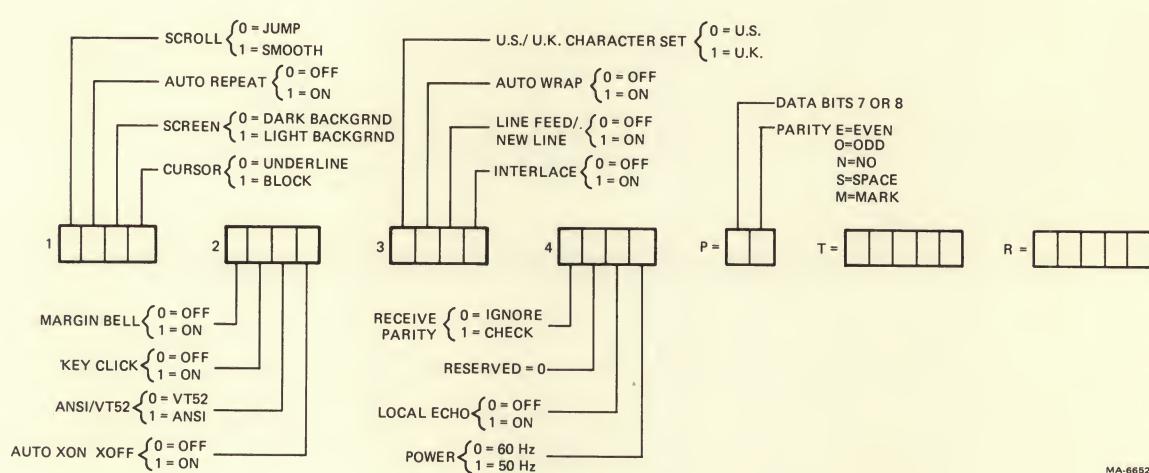


Figure B-2 SET-UP B Summary

PROGRAMMING SUMMARY

GENERAL

This appendix provides a summary of VT101 escape and control sequences.

Figure C-1 shows the codes generated by the standard keys. Figure C-2 shows the control codes generated by the function keys; shaded keys do not need **CTRL** down to generate the control character.

OCTAL CODES GENERATED BY KEYBOARD (SHIFTED CODES SHOWN ABOVE KEYCAP LEGENDS UNSHIFTED CODES SHOWN BELOW KEYCAP LEGENDS)															
	041 1!	100 062	043 063	044 064	045 065	136 6 ^	046 066	052 7 &	050 8 ^	051 9 (	051 0)	137 - -	153 = +	176 \ ~	
	121 Q 161	127 W 167	105 E 145	122 R 162	124 T 164	131 Y 171	125 U 165	111 I 151	117 O 157	120 P 160	173 | (	175 | )			
	CAPS LOCK 141	101 A 163	123 S 143	104 D 144	106 F 146	107 G 147	110 H 150	112 J 152	113 K 153	114 L 154	072 ; ;	042 " "		174 \	134
	SHIFT	132 Z 172	130 X 170	103 C 143	126 V 166	102 B 142	116 N 156	115 M 155	074 <	076 >	077 / ?	047	SHIFT		
040 SPACE 040															

MA-7419A

Figure C-1 Standard Key Codes

MNEMONICS SHOWN ABOVE KEYCAP LEGENDS OCTAL CODES SHOWN BELOW KEYCAP LEGENDS															
ESC 033														RS 036	BS 010
HT TAB 011	XON Q 021	ETB W 027	ENQ E 005	DC2 R 022	DC4 T 024	EM Y 031	NAK U 025	HT H 010	SI I 011	DLE P 020	ESC | | 033	GS | | 035	DEL DELE 177		
CTRL		SOH A 001	XOFF S 023	EOT D 004	ACK F 006	BEL G 007	BS H 010	LF J 012	VT K 013	FF L 014				FS | | 034	
		SUB Z 032	CAN X 030	ETX C 003	SYN V 026	STX B 002	SO N 016	CR M 015			US / ? 037			LP LINE FEED 012	
NUL 000															

MA-7419A

Figure C-2 Function Key Control Codes

Code	VT101 Keys	Previous Terminal Keys
NUL	CTRL - Space bar	CTRL - @
RS	CTRL - ~	CTRL - ^
US	CTRL - ?	CTRL - __

CONTROL CHARACTERS RECEIVED

Name	Character Mnemonic	Octal Code	Function
Null	NUL	000	Ignores when received (not stored in input buffer), used as a fill character
Enquire	ENQ	005	Transmits answerback message
Bell	BEL	007	Generates a bell tone
Back space	BS	010	Moves cursor to the left one character position, unless it is at the left margin, in which case no action occurs
Horizontal tab	HT	011	Moves cursor to the next tab stop, or to the right margin if there are no more tab stops
Linefeed	LF	012	Causes a linefeed or a new line operation (Refer to linefeed/new line mode)
Vertical tab	VT	013	Processed as LF
Form feed	FF	014	Processed as LF
Carriage return	CR	015	Moves cursor to left margin on the current line
Shift out	SO	016	Selects G1 character set, as designated by a Select Character Set sequence

Name	Character Mnemonic	Octal Code	Function
Shift in	SI	017	Selects GO character set, as designated by a Select Character Set sequence
Device control 1	DC1	021	Processed as XON, causes terminal to continue transmitting characters
Device control 3	DC3	023	Processed as XOFF, causes terminal to stop transmitting all characters except XOFF and XON
Cancel	CAN	030	Cancels sequence received during an escape or control sequence, and the substitution character (⌘) is displayed
Substitute	SUB	032	Processed as CAN
Escape	ESC	033	Processed as a sequence introducer

ANSI COMPATIBLE SEQUENCES

Set Mode

Name	Mnemonic	Mode	Sequence
Linefeed / new line	LMN	New line	ESC [2 0 h
Cursor key	DECCKM	Application	ESC [? 1 h
ANSI / VT52	DECANM	ANSI	N/A
Column	DECCOLM	132 column	ESC [? 3 h
Scrolling	DECSCLM	Smooth	ESC [? 4 h
Screen	DECSCNM	Reverse	ESC [? 5 h
Origin	DECOM	Relative	ESC [? 6 h
Auto wrap	DECAWM	On	ESC [? 7 h
Auto repeat	DECARM	On	ESC [? 8 h
Interlace	DECINLM	On	ESC [? 9 h

Reset Mode

Name	Mnemonic	Mode	Sequence
Linefeed / new line	LMN	Linefeed	ESC [2 0 | *
Cursor key	DECCKM	Cursor	ESC [? 1 | *
ANSI / VT52	DECANM	VT52	ESC [? 2 | *
Column	DECCOLM	80 column	ESC [? 3 | *
Scrolling	DECSCLM	Jump	ESC [? 4 | *
Screen	DECSCNM	Normal	ESC [? 5 | *
Origin	DECOM	Absolute	ESC [? 6 | *
Auto wrap	DECAWM	Off	ESC [? 7 | *
Auto repeat	DECARM	Off	ESC [? 8 | *
Interlace	DECINLM	Off	ESC [? 9 | *

*The last character of the sequence is lowercase L (1548).

Cursor Key Codes Generated

Cursor Key (Arrow)	ANSI Characters Generated	
	Reset (Cursor)	Set (Application)
Up	ESC [A	ESC O A
Down	ESC [B	ESC O B
Right	ESC [C	ESC O C
Left	ESC [D	ESC O D

Keypad Character Selection

Name	Mnemonic	Sequence
Alternate Numeric	DECKPAM	ESC =
	DECKPNM	ESC >

Keypad Codes Generated

Key	VT52 Numeric Keypad Mode	VT52 Alternate Keypad Mode	ANSI Numeric Keypad Mode	ANSI Alternate Keypad Mode
0	0	ESC ? p	0	ESC O p
1	1	ESC ? q	1	ESC O q
2	2	ESC ? r	2	ESC O r
3	3	ESC ? s	3	ESC O s
4	4	ESC ? t	4	ESC O t
5	5	ESC ? u	5	ESC O u
6	6	ESC ? v	6	ESC O v
7	7	ESC ? w	7	ESC O w
8	8	ESC ? x	8	ESC O x
9	9	ESC ? y	9	ESC O y
— (minus)	— (minus)	ESC ? m	— (minus)	ESC O m
, (comma)	, (comma)	ESC ? l *	, (comma)	ESC O l *
. (period)	. (period)	ESC ? n	. (period)	ESC O n
ENTER	Same as RETURN	ESC ? M	Same as RETURN	ESC O M
PF1	ESC P	ESC P	ESC O P	ESC O P
PF2	ESC Q	ESC Q	ESC O Q	ESC O Q
PF3	ESC R	ESC R	ESC O R	ESC O R
PF4	ESC S	ESC S	ESC O S	ESC O S

*The last character of the sequence is lowercase L (1548).

Select Character Sets (SCS)

Character Set	G0 Designator	G1 Designator
United Kingdom (UK)	ESC (A	ESC) A
United States (USASCII)	ESC (B	ESC) B
Special characters and line drawing set	ESC (O	ESC) O
Name	Mnemonic	Sequence
Single shift 2	SS2	ESC N
Single shift 3	SS3	ESC O

US/UK Character Set

BITS			0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1			
B4	B3	B2	B1	ROW	0	1	2	3	4	5	6	7	
0 0 0 0	0	NUL	0		20	SP	40	0	60	@	100	P	120
0 0 0 1	1		1	DC1 (XON)	21	!	41	1	61	A	101	Q	121
0 0 1 0	2		2		22	"	42	2	62	B	102	R	122
0 0 1 1	3		3	DC3 (XOFF)	23	*	#	3	63	C	103	S	123
0 1 0 0	4		4		24	\$	44	4	64	D	104	T	124
0 1 0 1	5	ENQ	5		25	%	45	5	65	E	105	U	125
0 1 1 0	6		6		26	&	46	6	66	F	106	V	126
0 1 1 1	7	BEL	7		27	'	47	7	67	G	107	W	127
1 0 0 0	8	BS	10	CAN	30	(	50	8	70	H	110	X	130
1 0 0 1	9	HT	11		31	)	51	9	71	I	111	Y	131
1 0 1 0	10	LF	12	SUB	32	*	52	:	72	J	112	Z	132
1 0 1 1	11	VT	13	ESC	33	+	53	;	73	K	113	[	133
1 1 0 0	12	FF	14		34	,	54	<	74	L	114	\	134
1 1 0 1	13	CR	15		35	-	55	=	75	M	115	]	135
1 1 1 0	14	SO	16		36	.	56	>	76	N	116	^	136
1 1 1 1	15	SI	17		37	/	57	?	77	O	117	—	137
			15		31		47		63		79		95
			F		1F		2F		3F		4F		5F

*NOTE: DEPENDS ON THE CHARACTER SET SELECTED; U.S.=# U.K.=£

KEY

ASCII CHARACTER	ESC	33 27 1B	OCTAL DECIMAL HEX
-----------------	-----	----------------	-------------------------

Special Character and Line Drawing Set

BITS B7 B6 B5 B4 B3 B2 B1 ROW		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1										
		COLUMN 0		1		2		3		4		5		6		7										
		NUL	0	20	16	SP	40	32	20	0	60	48	30	@	100	64	P	120	80	50	◆	140	96	60	—	160	112	70
0 0 0 0 0	0	1	1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	141 97 61	SCAN 3	161 113 71										
0 0 0 1 1	1	2	2	DC3 (XOFF)	22 18 12	“	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	142 98 62	SCAN 7	162 114 72										
0 0 1 1 3	3	3	3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	143 99 63	SCAN 9	163 115 73										
0 1 0 0 4	4	4	4		24 20 14	\$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	144 100 64	SCAN 4	164 116 74										
0 1 0 1 5	5	ENQ	5		25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	145 101 65	SCAN 5	165 117 75										
0 1 1 0 6	6		6		26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	0	146 102 66	SCAN 6	166 118 76									
0 1 1 1 7	7	BEL	7		27 23 17	/	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	±	147 103 67	SCAN 7	167 119 77									
1 0 0 0 8	8	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	NL	150 104 68	SCAN 8	170 120 78								
1 0 0 1 9	9	HT	11 9 9		31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	¶	151 105 69	SCAN 9	171 121 79								
1 0 1 0 10	10	LF	12 10 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	J	152 106 6A	SCAN 10	172 122 7A									
1 0 1 1 11	11	VT	13 11 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	1	153 107 6B	SCAN 11	173 123 7B								
1 1 0 0 12	12	FF	14 12 C		34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	Γ	154 108 6C	SCAN 12	174 124 7C									
1 1 0 1 13	13	CR	15 13 D		35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	L	155 109 6D	SCAN 13	175 125 7D								
1 1 1 0 14	14	SO	16 14 E		36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	▲	136 94 5E	+	156 110 6E	SCAN 14	176 126 7E									
1 1 1 1 15	15	SI	17 15 F		37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	(BLANK)	137 95 5F	—	157 111 6F	SCAN 15	177 127 7F									

KEY

ASCII CHARACTER

ESC	33 27 1B	OCTAL DECIMAL HEX
-----	----------------	-------------------------

Character Attributes

Name	Mnemonic	Sequence
Select graphic rendition (no attributes)	SGR	ESC [m
Select graphic rendition (no attributes)	SGR	ESC [0 m
Select graphic rendition (select attributes, reverse video, or underline as determined by cursor SET-UP feature)	SGR	ESC [4 m
Select graphic rendition (select attributes, reverse video, or underline as determined by cursor SET-UP feature)	SGR	ESC [7 m

Scrolling Region

Name	Mnemonic	Sequence
Set top and bottom margins	DECSTBM	ESC [Pt; Pb r

Cursor Movement Commands

Name	Mnemonic	Sequence
Cursor up	CUU	ESC [Pn A
Cursor down	CUD	ESC [Pn B
Cursor forward (right)	CUF	ESC [Pn C
Cursor backward (left)	CUB	ESC [Pn D
Cursor position	CUP	ESC [Pl; Pc H
Cursor position (home)	CUP	ESC [H
Horizontal and vertical position	HVP	ESC [Pl; Pc f
Horizontal and vertical position (home)	HVP	ESC [f
Index	IND	ESC D
Reverse index	RI	ESC M
Next line	NEL	ESC E
Save cursor (and attributes)	DECSC	ESC 7
Restore cursor (and attributes)	DECRC	ESC 8

Tab Stops

Name	Mnemonic	Sequence
Horizontal tab set (at current column)	HTS	ESC H
Tabulation clear (at current column)	TBC	ESC [g
Tabulation clear (at current column)	TBC	ESC [0 g
Tabulation clear (all tabs)	TBC	ESC [3 g

Line Attributes

Name	Mnemonic	Sequence
Double-height top half	DEC DHL	ESC # 3
Double-height bottom half	DEC DHL	ESC # 4
Single-width single-height	DEC SWL	ESC # 5
Double-width single-height	DEC DWL	ESC # 6

Erasing

Name	Mnemonic	Sequence
Erase in line (cursor to end of line)	EL	ESC [K
Erase in line (cursor to end of line)	EL	ESC [0 K
Erase in line (beginning of line to cursor)	EL	ESC [1 K
Erase in line (entire line containing cursor)	EL	ESC [2 K
Erase in display (cursor to end of screen)	ED	ESC [J
Erase in display (cursor to end of screen)	ED	ESC [0 J
Erase in display (beginning of screen to cursor)	ED	ESC [1 J
Erase in display (entire screen)	ED	ESC [2 J

Reports

Name	Mnemonic Sequence	
Device status report (request status of VT101)	DSR	ESC [5 n
Response:		
Terminal OK	DSR	ESC [0 n
Terminal not OK	DSR	ESC [3 n
Device status report (report cursor position)	DSR	ESC [6 n
Cursor position report	CPR	ESC [P1; Pc R
Device attributes (what are you)	DA	ESC [c
Device attributes (what are you)	DA	ESC [0 c
Identify terminal (what are you)	DECID	ESC Z

NOTE: ESC Z is not recommended.

Device attributes Response: VT101	DA	ESC [? 1; 0 c
--------------------------------------	----	----------------

Reset

Name	Mnemonic Sequence	
Reset to initial state	RIS	ESC c

Test and Adjustments

Name	Mnemonic Sequence	
Screen alignment display (fill screen with "Es")	DECALN	ESC # 8
Invoke confidence test (power-up test)	DECTST	ESC [2 ; 1 y
Invoke confidence test (data loopback test, requires test connector)	DECTST	ESC [2 ; 2 y

Name	Mnemonic	Sequence
Invoke confidence test (repeat power-up test continuously until failure or power-off)	DECTST	ESC [2 ; 9 y
Invoke confidence test (repeat data loopback test continuously until failure or power-off, requires test connector)	DECTST	ESC [2 ; 10 y

Keyboard Indicators

Name	Mnemonic	Sequence
Load LEDs (all off)	DECLL	ESC [q
Load LEDs (all off)	DECLL	ESC [0 q
Load LEDs (L1 on)	DECLL	ESC [1 q
Load LEDs (L2 on)	DECLL	ESC [2 q
Load LEDs (L3 on)	DECLL	ESC [3 q
Load LEDs (L4 on)	DECLL	ESC [4 q

VT52 COMPATIBLE MODE

Set and Reset Modes	Sequence
Enter ANSI mode	ESC <

Keypad Character Selection

Name	Sequence
Enter alternate keypad mode	ESC =
Exit alternate keypad mode (numeric keypad mode)	ESC >

Character Sets

Name	Sequence
Special graphics character set	ESC F*
Select character set (as determined by US/UK character SET-UP feature)	ESC G

Cursor Position

Name	Sequence
Cursor up†	ESC A
Cursor down†	ESC B
Cursor right†	ESC C
Cursor left†	ESC D
Cursor to home	ESC H
Direct cursor address	ESC Y Pl Pct‡
Reverse line feed	ESC I

Erasing

Name	Sequence
Erase to end of line	ESC K
Erase to end of screen	ESC J

Reports

Name	Sequence
Identify (what are you)	ESC Z
Response: VT101	ESC/Z

*Same as special character and line drawing set in ANSI mode.

†Same when sent from the terminal.

‡Line and column numbers for direct cursor address are single character codes whose values are the desired number plus 37(8). Line and column numbers start at one.

The last character of the sequence is an uppercase i (1118).

CONTROL FUNCTIONS (SEQUENCE FORMATS)

D

GENERAL

This appendix describes the ANSI code extension techniques as defined in standards X3.41-1974 and X3.64-1979. Many special cases and details in the specifications are not covered here.

CONTROL FUNCTIONS

The ANSI standards define types of characters used for specific purposes. The character type is determined by the position of the character in the ASCII table (Table D-1). The character table is divided into two general categories: display characters (columns 2 through 7) and control characters (columns 0 and 1). This table and the ANSI system can work for either a 7-bit or 8-bit character environment. The VT101 uses only 7-bit characters.

NOTE: The ASCII 7-bit table corresponds to International Standards Organization (ISO) standard 646 and International Telegraph and Telephone Consultive Committee (CCITT) Alphabet 5.

All control characters and character groups (sequences) not intended for display on the screen are part of the system called control functions. Not all control functions perform an action in every ANSI device, but each device can recognize all control functions and discard any that do not apply. Therefore, each device performs a subset of the ANSI functions.

Because different devices use different subsets, compliance with ANSI does not mean compatibility between devices. Compliance only means that a particular function, if defined in the ANSI standard, is invoked by the same control function in all devices. If an ANSI device does not perform an action that has a control function defined in the ANSI standard, it cannot use that control function for any other purpose.

Table D-1 ASCII Table

BITS			0 0 0			0 0 1			0 1 0			0 1 1			1 0 0			1 0 1			1 1 0			1 1 1				
			COLUMN			0			1			2			3			4			5			6			7	
B7	B6	B5	B4	B3	B2	B1	ROW																					
0	0	0	0	0	0	0	0	NUL	0	0	DLE	20	SP	40	0	60	@	100	P	120	‘	140	p	160	112	70		
0	0	0	1	1	1	1	1	SOH	1	1	DC1 (XON)	21	!	41	1	61	A	101	Q	121	a	141	q	161	113	71		
0	0	1	0	2	2	2	2	STX	2	2	DC2	22	“	42	2	62	B	102	R	122	b	142	r	162	114	72		
0	0	1	1	3	3	3	3	ETX	3	3	DC3 (XOFF)	23	#	43	3	63	C	103	S	123	c	143	s	163	115	73		
0	1	0	0	4	4	4	4	EOT	4	4	DC4	24	\$	44	4	64	D	104	T	124	d	144	t	164	116	74		
0	1	0	1	5	5	5	5	ENQ	5	5	NAK	25	%	45	5	65	E	105	U	125	e	145	u	165	117	75		
0	1	1	0	6	6	6	6	ACK	6	6	SYN	26	&	46	6	66	F	106	V	126	f	146	v	166	118	76		
0	1	1	1	7	7	7	7	BEL	7	7	ETB	27	,	47	7	67	G	107	W	127	g	147	w	167	119	77		
1	0	0	0	8	10	8	8	BS	10	8	CAN	30	(	50	8	70	H	110	X	130	h	150	x	170	120	78	
1	0	0	1	9	11	9	9	HT	11	9	EM	31	)	51	9	71	I	111	Y	131	i	151	y	171	121	79	
1	0	1	0	10	12	10	A	LF	12	26	SUB	32	*	52	:	72	J	112	Z	132	j	152	z	172	122	7A		
1	0	1	1	11	13	11	B	VT	13	27	ESC	33	+	53	;	73	K	113	[	133	k	153	{	173	123	7B	
1	1	0	0	12	14	12	C	FF	14	28	FS	34	,	54	<	74	L	114	\	134	l	154	|	174	124	7C		
1	1	0	1	13	15	13	D	CR	15	29	GS	35	-	55	=	75	M	115	]	135	m	155	}	175	125	7D	
1	1	1	0	14	16	14	E	SO	16	30	RS	36	.	56	>	76	N	116	A	136	n	156	~	176	126	7E		
1	1	1	1	15	17	15	F	SI	17	31	US	37	/	57	?	77	O	117	—	137	o	157	DEL	177	127	7F		

KEY

ASCII CHARACTER	ESC	33	OCTAL
		27	DECIMAL
		1B	HEX

ESCAPE AND CONTROL SEQUENCES

Escape and control sequences provide more controls than the control characters of the ASCII 7-bit table. These sequences are multiple character control functions. They are not displayed but are used to control display, processing, and transmission of characters. At the end of the multiple character control sequence or during an error condition, the terminal continues to display received characters. (Error conditions are defined in Chapter 4.)

Escape Sequences

The format for an escape sequence is as follows.

ESC	I....I	F
033	040-057	060-176
Escape sequence introducer	Intermediate characters (0 or more characters)	Final character (1 character)

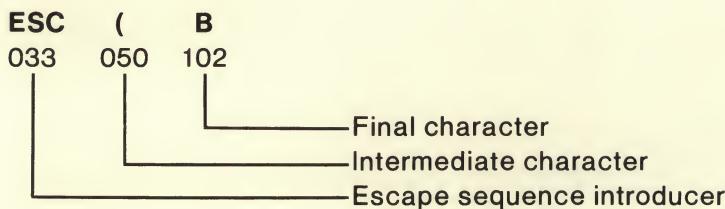
Escape Sequence Introducer – The escape sequence introducer is the ESC character (octal 033) defined by ANSI X3.4-1977. After the ESC character is received, all characters received in the proper range are not displayed but are stored to be used as control functions.

Intermediate Characters – If the characters received after the ESC character are in the octal range of 040-057 (column 2 of the ASCII table), they are intermediate characters. These characters are stored as part of the control function.

Final Character – If the character received after the ESC character is in the octal range of 060-176 (columns 3-7 of the ASCII table), it is a final character. The final character indicates the end of the control function. The intermediate and final characters together define the function of the sequence. The terminal performs the action specified by the control function and continues to display received characters. ANSI standard control functions have a final character in the octal range of 100-176 (columns 4-7 of the ASCII table). Private sequences have a final character in the octal range of 060-077 (column 3 of the ASCII table).

Example

Action: Designate ASCII character set as G0.

Sequence:**Control Sequence Format**

The format of a control sequence is as follows.

CSI	P.....P	I.....I	F
033 133	060-077	040-057	100-176
Control sequence introducer	Parameter characters (0 or more characters)	Intermediate characters (0 or more characters)	Final character (1 character)

Control Sequence Introducer – The control sequence introducer (CSI) is the ESC (octal 033) and [(octal 133) characters defined by ANSI X3.41-1977. These characters are used to gain 8-bit control functions using 7-bit characters. The VT101 supports only 7-bit characters. After the CSI characters are received, all characters received in the proper range are not displayed but are stored to be used as control functions.

Parameter Characters – If the characters received after the CSI characters are in the octal range of 060-077 (column 3 of the ASCII table), the characters are parameter characters. Parameter characters modify the action or interpretation of the control function. Parameter characters are interpreted as private when the < = > ? characters (octal 074-077) are transmitted at the beginning of the parameter string. [The : character (octal 072) is reserved.] This means that a control sequence can be specified by ANSI but the parameter function can have a private interpretation.

The terminal uses two types of parameter characters: numeric and selective. A numeric parameter represents a decimal number, designated by Pn. The decimal characters have a range of 0 (octal 060) to 9 (octal 071). A selective is a parameter selected from a list of specified parameters, designated by Ps.

If more than one parameter is transmitted in the control sequence, the parameters are separated by a delimiter character, the ; character (octal 073).

Intermediate Characters – If characters received after the CSI characters are in the octal range of 040-057 (column 2 of the ASCII table), they are intermediate characters. These characters are stored as part of the control function.

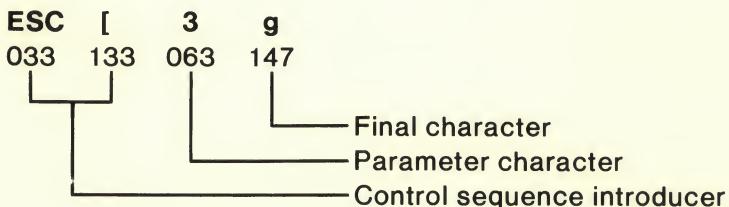
NOTE: The VT101 does not use intermediate characters in control functions.

Final Character – If the character received after the CSI characters is in the octal range of 100-176 (columns 4-7 of the ASCII table), it is a final character. The final character indicates the end of the control function. The intermediate and final characters together define the function of the sequence. The VT101 performs the action specified by the control function and continues to display received characters. ANSI standard control functions are assigned a final character in the octal range of 100-157 (columns 4-6 of the ASCII table). Private sequences have a final character in the octal range of 160-176 (column 7 of the ASCII table).

Example

Action: Clear all horizontal tabs.

Sequence:



Examples

These examples show the use of multiple functions selected in one sequence, private parameters, and private sequences.

ESC [? 4 h Set smooth scroll mode
 033 133 077 064 150 (? = ANSI private parameter)

ESC [2 ; 1 y Invoke self-test (y = ANSI private sequence)
 033 133 062 073 061 171

E VT101/VT100 DIFFERENCES

GENERAL

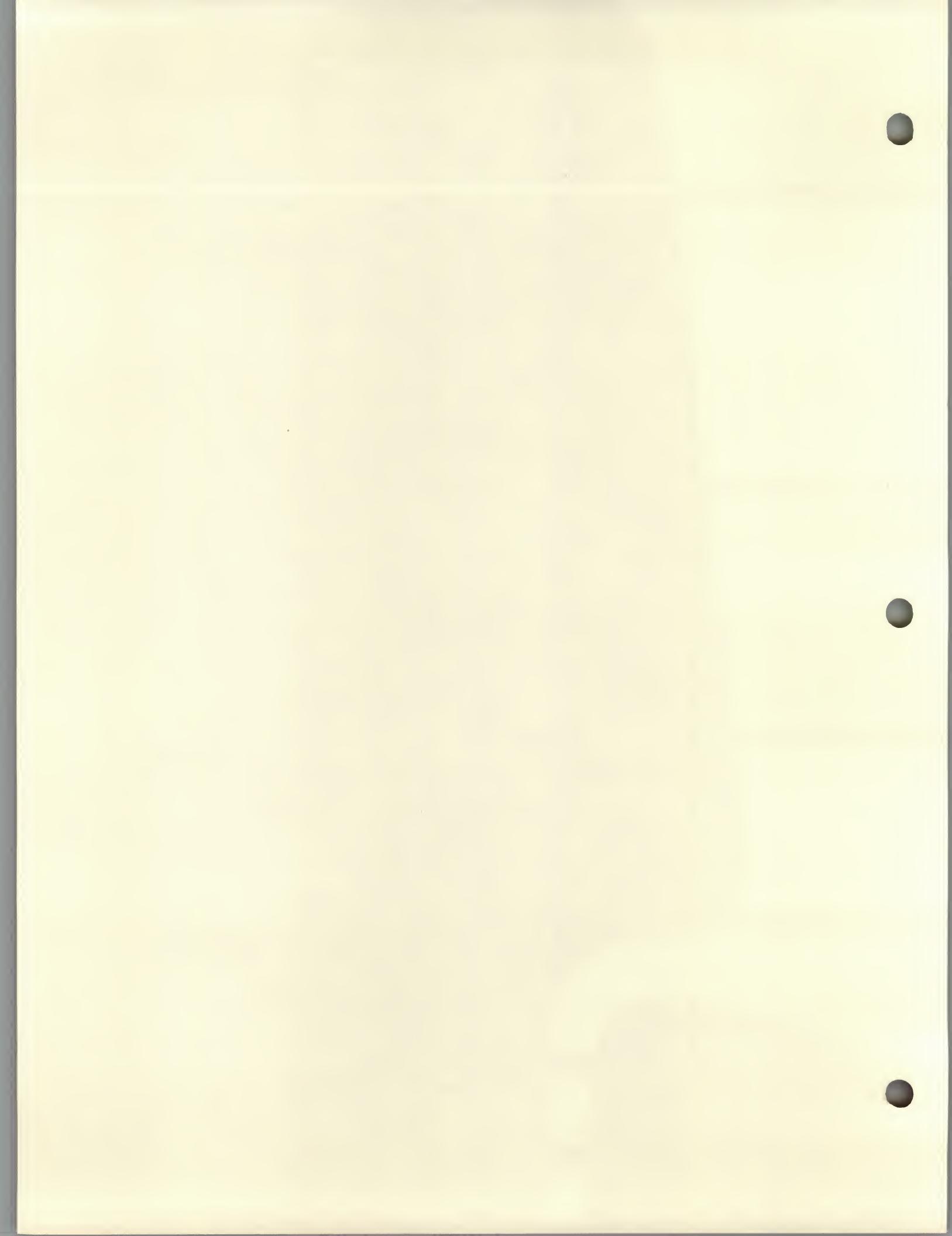
This appendix describes the differences between the VT101 and VT100 video terminals. The VT101 is a bounded video terminal with no expansion or upgrade capabilities. Therefore, the VT101 differs from the VT100 because of the following restrictions.

1. There are no advanced video option (AVO) functions (added character attributes, added screen memory, and ROM sockets).
2. EIA loopback tests cannot be performed.

NOTE: Both the VT100 and VT101 terminals can perform data loop-back self-tests.

3. There are no standard terminal port connector functions or features, such as the printer interface option. Report Parameters (DECREPTPARM) is not provided.
4. There is no video input connector.
5. There is no graphics connector. (This is an internal connector of the VT100.)
6. EIA connector pin 23 connection to pins 11 and 19.

Index



INDEX

A

Accessories, 127
Adjustments, 84
Alternate keypad
 Keys, 45
 Alternate keypad mode (see application keypad mode), 69, 88
 ANSI-compatible sequences, 54
ANSI/VT52
 Feature, 32
 Mode, 58, 86
Answerback
 Feature, 38
 Keys, 11
Application keypad
 Keys, 45
 Application keypad mode, 69, 88
Attributes
 Character, 76
 Device, 81
 Line, 78
Audible indicators
 Bell tone, 13
 Keyclick, 13
 Series of bell tones, 13
Auto (key) repeat
 Feature, 31
 Mode, 68
Auto new line at margin (see auto wrap), 33, 65
Auto wrap
 Feature, 33
 Mode, 65
Auto XON/XOFF, 32

B

Background (screen), 31, 66
Backspace key, 8
Baud rate
 Receive speed feature, 37
 Transmit speed feature, 36
Bell, 13, 32
Bits
 Bits per character (data/parity bits feature), 34
 Stop bits (see transmit or receive speed), 36, 37
Block cursor (see cursor feature), 31
Break, 7, 42, 96
Brightness (see screen brightness feature), 24
Buffer overflows (see auto XON/XOFF), 32, 98

C

Cables, 109
CAPS LOCK key, 6
Characters
 Control, 49
 Display, 49
 Fill, 99
 Received, 47
 Serial, 85
 Transmitted, 41
Character attributes, 76
Character bits (data/parity bits feature), 34
Character sets and selection, 33, 71, 90
Characters per line (see columns per line), 26, 64

Checkout procedure
 Terminal, 111
 20 mA option, 117
 Check parity (see receive parity feature), 33
 CLEAR ALL TABS key, 9
 Click (see keyclick feature), 32
 Column mode, 65
 Columns per line feature, 26, 64
 Communication
 Cables, 109
 Connector, 93
 Connection, 98
 Disconnection, 98
 Full-duplex, 96
 Compatibility
 ANSI sequences, 54
 VT52 sequences, 58
 Contrast (see screen brightness feature), 24
 Control character
 Description, 49
 Keys, 43
 Controls
 Communication, 4
 Keyboard, 4
 Monitor, 3
 Control sequences (see escape and control sequences), 50
 CPR (see cursor position report), 81
 CTRL key, 8, 43
 CUB (see cursor backward), 62
 CUD (see cursor down), 62
 CUF (see cursor forward), 62
 CUP (see cursor position), 62
 Current loop, 113
 Cursor addressing, 88
 Cursor backward (left), 62, 87
 Cursor down, 62, 87
 Cursor feature, 31
 Cursor forward (right), 62, 87
 Cursor key mode, 68
 Cursor keys, 8, 42
 Cursor position, 62
 Cursor positioning, 61, 86
 Cursor position report, 81
 Cursor to home, 63, 87
 Cursor up, 61, 87
 CUU (see cursor up), 61

D

DA (see device attributes), 81
 Dark screen (see screen background), 31, 66
 Data bits (data/parity bits feature), 34
 Data loopback self-test, 125
 Data/parity bits
 Data/parity bits feature, 34
 Data/parity bits keys, 11
 DECALN (see screen alignment display), 84
 DECANM (see ANSI/VT52 compatibility), 58, 86
 DECARM (see auto repeat mode), 68
 DECAWM (see auto wrap), 65
 DECKKM (see cursor key mode), 68
 DECCOLM (see column mode), 65
 DECDHL (see double-height line), 78
 DECDWL (see double-width line), 78
 DECID (see identify terminal), 81
 DECINLM (see interlace mode), 66
 DECKPAM (see application keypad mode), 69
 DECKPNM (see numeric keypad mode), 69
 DECLL (see load LEDs), 84
 DECOM (see origin mode), 60
 DECRC (see restore cursor), 64
 DECSC (see save cursor), 64
 DECSCLM (see scroll mode), 59
 DECSNM (see screen mode), 66
 DECSTBM (see set top and bottom margins), 60
 DECSWL (see single-width line), 78
 DECTST (see invoke confidence test), 83
 Default keys, 12
 Default memory, 20
 DELETE key, 8
 Device attributes, 81
 Device status report, 80
 Dimensions, 104
 Direct cursor address, 88
 Display characters, 49
 Documentation, 132
 Double-height line, 78
 Double-width line, 78
 DSR (device status report), 80

E

Echo (see local echo feature), 34
 ED (see erase in display), 79
 EIA, 93
 80/132 columns (see columns per line), 26, 64
 80/132 columns key, 10
 EL (see erase in line), 79
 Erase in line, 79
 Erase in display, 79
 Erase to end of line, 92
 Erase to end of screen, 92
 Erasing, 79, 92
 Escape sequences (see escape and control sequences), 50
 ESC key, 8

F

Feature memories
 Default, 20
 Operating, 18
 User, 18
 Features
 General, 23
 SET-UP A, 26
 SET-UP B, 28
 Feature types
 Communication Compatibility, 22
 Installation, 22
 Operator preference, 22
 Fill characters, 99
 Full-duplex communication
 Connection, 98
 Description, 96
 Disconnection, 98
 Signals, 96
 Function keys, 7, 42

G

General default, 20
 Graphics mode (see VT52 character sets), 90

H

Home position (see origin mode), 60
 Horizontal and vertical position, 63
 Horizontal tabulation set, 77
 HTS (see horizontal tab set), 77
 HVP (see horizontal and vertical position), 63

I

Identify, 92
 Identify terminal, 81
 Ignore parity (see receive parity feature), 33
 IND (see index), 63
 Index, 63
 Indicators (see keyboard indicators), 12
 Input buffer overflows (see auto XON/XOFF), 32, 98
 Installation
 Terminal, 103
 20 mA option, 113
 Installation procedure
 Terminal, 107
 20 mA option, 114
 Interlace
 Feature, 33
 Mode, 66
 Internal communication switches, 4
 Invoke confidence test, 83

J

Jump scroll
 Scroll mode, 59
 SET-UP feature (see scroll feature), 30

K

KBD locked (see keyboard locked indicator), 12
 Keyboard controls, 4
 Keyboard (keys)
 Function, 7, 42
 SET-UP, 9
 Standard, 6, 41

Keyboard indicators, 12, 84
 Keyboard locked indicator, 12
 Keyboard transmit buffer, 91
 Keyclick, 13, 32
 Keypad application mode, 69, 88
 Keypad key codes, 45, 79
 Keypad numeric mode, 69, 88
 Key repeat (see auto repeat), 31, 68

L

Light screen (see screen background feature), 31, 66
 Line attributes, 78
 Linefeed key, 9
 Linefeed/new line
 Feature, 33
 Mode, 67
 LNM (see linefeed/new line mode), 67
 Load LEDs, 84
 Local echo, 34
 L1-L4 indicators, 13, 84
 Loopback self-tests, 125
 Low-speed operation, 100

M

Maintenance, 121
 Margin
 Margin bell feature, 32
 Set top and bottom margins, 59
 Memories, 17
 Modem
 Cables, 109
 Connector, 93
 Serial characters, 95
 Receive speed feature, 37
 transmit speed feature, 36
 Modes
 ANSI (SET-UP features and mode selection), 54
 VT52 mode selection, 58
 VT52 mode sequences, 85

N

NEL (see next line), 63
 New line (see linefeed/new line), 33, 67
 Next line, 63
 NO SCROLL key, 7

/ £ key, 33, 71
 Numeric keypad
 Keys, 45
 Mode, 69, 88
 NVR (see user memory), 18

O

OFF-LINE
 Description, 1
 Feature, 24
 Indicator, 12
 ON-LINE
 Description, 1
 Feature, 24
 Indicator, 12
 ON/OFF-LINE
 Feature, 24
 Key, 10
 Operating information, 1
 Operating memory, 18
 Options, 113
 Option
 Checkout, 117
 Installation, 114
 Origin mode, 60

P

Packing procedure, 106
 Parity
 Data/parity bits feature, 34
 Receive parity feature, 33
 Power
 Feature, 34
 Switch, 4
 Power-up and checkout procedure, 111
 Power-up self-test, 124

R

Recall, 19
 Recall keys, 11
 Receive parity feature, 33
 Receive speed feature, 37
 Receive speed key, 10
 Received characters, 47
 Repeat (see auto repeat), 31
 Reports, 80, 92
 Reset, 20, 82

RESET key, 11
 Reset mode, 55
 Reset to initial state, 82
 Restore cursor, 64
 RETURN key, 8
 Reverse index, 63
 Reverse linefeed, 88
 Reverse screen (see screen background feature), 31
 Reverse video, 66, 76
 RI (see reverse index), 63
 RIS (see reset to initial state), 82
 RM (see reset mode), 54

S

Save (see store feature), 18
 Save cursor, 64
 Screen alignment display, 84
 Screen background
 Feature, 31
 Mode, 66
 Screen brightness
 Feature, 24
 Keys, 11
 Screen mode, 66
 Screen width (see columns per line feature), 26, 64
 Scroll feature
 Jump, 30
 Smooth, 30
 Scroll mode, 59
 Scrolling region, 59
 SCS (see select character set), 75
 Select character set, 75
 Select graphic rendition, 76
 Self-test, 82, 123
 Sequences
 ANSI, 54
 ANSI-compatible, 54
 Escape and control, 50
 VT52, 85
 VT52-compatible, 58, 85
 Serial characters, 95
 SET/CLEAR TAB key, 9
 Set mode, 54
 Set top and bottom margins (see scrolling region), 59
 SET-UP, 15
 SET-UP A features, 26

SET-UP B features, 28
 SETUP A/B key, 10
 SET-UP features (see feature descriptions), 23
 SET-UP features and modes, 54
 SET-UP key, 9
 SET-UP memories (see feature memories), 17
 SGR (see select graphic rendition), 76
 SHIFT key, 6
 Single-width line, 78
 Single shift 2, 76
 Single shift 3, 76
 Site considerations, 103
 60/50 Hz (see power feature), 34
 SM (see set mode), 54
 Smooth scroll
 SET-UP feature (see scroll feature), 30
 Scroll mode, 59
 Special character and line drawing set (see character sets and selection), 71
 Special graphics (see character sets and selection), 90
 Speed
 Receive speed feature, 37
 Transmit speed feature, 36
 Standard keys, 6, 41
 Stop bits (see transmit or receive speed features), 36, 37
 Store
 Keys, 12
 Feature, 18
 SS2 (see single shift 2), 76
 SS3 (see single shift 3), 76

T

Tabs stops (set/clear), 9, 26, 77
 Tab Default
 Feature, 22
 Keys, 12
 TAB key, 8
 Tabulation clear, 77
 Terminal dimensions, 104
 Terminal operation, 1
 Tests, 82, 123
 TBC (see tabulation clear), 77
 TOGGLE 0/1 key, 10
 Top and bottom margins, 60
 Transmit speed feature, 36

Transmit buffer (see keyboard transmit buffer), 101
TRANSMIT SPEED key, 10
Transmitted characters, 41
Troubleshooting, 121
20 mA option, 113
20 mA switches, 4
20 mA switches selection (see option installation), 114

U

Underline attribute, 76
Underline cursor (see cursor feature), 31
Unpacking and inspection procedures, 105
US/UK character sets feature, 33
User memory, 18

V

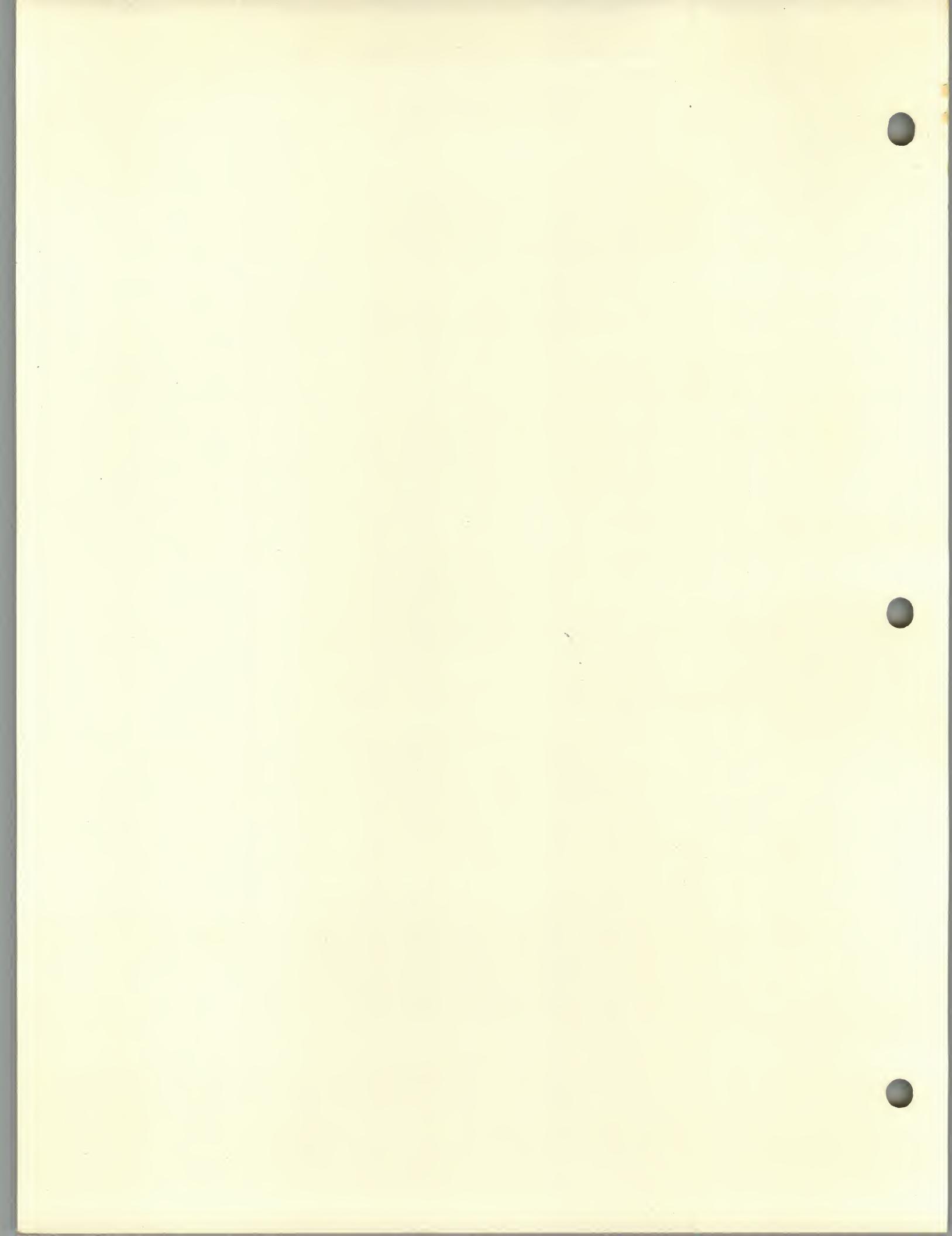
Voltage selection switch, 4
VT52
 Feature, 32
 Mode, 58
VT52-compatible sequences, 85

W

Wraparound (see auto wrap), 33, 65

X

XON/XOFF feature (see auto XON/XOFF), 32, 98



INSTALLATION, WARRANTY, AND SERVICE INFORMATION

INSTALLATION/WARRANTY

For customers who have purchased directly from DIGITAL, reference the sales agreement for installation and warranty terms purchased with this terminal.

For customers who have purchased, leased, or rented from a vendor other than DIGITAL, contact your vendor for information regarding installation and warranty terms purchased with this terminal.

DIGITAL SERVICES

DIGITAL provides a wide range of maintenance and customer services for your terminal. Using these services, you can design a plan to meet your service needs, from complete DIGITAL maintenance to complete self-maintenance. Vendors supplying DIGITAL products may use these services as factory backup support.

- **On-Site Service**

DIGITAL offers responsive, low cost, factory-level maintenance performed at your site by trained Terminals Service Specialists. This maintenance is provided through service agreements or per-call service.

- Service Agreements cover all your maintenance needs, including priority response; labor, materials, and travel for a fixed monthly charge.
- Per-call service is provided on a "time" and "materials" basis and can serve as a backup to your own in-house maintenance programs.

- **Off-Site Service**

For customers who have troubleshooting expertise, but need assistance for the component repair, DIGITAL has a worldwide network of Product Repair Centers (PRCs) and the Customer Returns Area (CRA). Through a wide array of service product offerings this logistics network offers cost effective services that include the following features.

- Module Mailer
- Fixed Price Exchange
- Product Refurbishment

- **Spare Parts**

In further effort to assist customers who choose to perform their own computer maintenance, DIGITAL's Customer Spares organization provides thorough and timely spares support through the following features.

- Spares Inventory Planning
- Component/Subassembly Spares
- Maintenance Test Equipment
- Maintenance Documentation Service
- Emergency Spare Parts

- **Training**

DIGITAL's Education Services group offers hardware maintenance courses at any of our 17 worldwide training centers; or, depending on your specific training requirements, courses can be provided in your own facilities.

ORDERING SUPPLIES AND ACCESSORIES

Purchase orders for supplies and accessories should be forwarded to:

Digital Equipment Corporation
Supplies and Accessories
Cotton Road
Nashua, New Hampshire 03060

Contact your local sales office or call DIGITAL Direct Catalog Sales toll-free (800-258-1710) from 8:30 a.m. to 5:00 p.m. eastern standard time (U.S. Customers only). New Hampshire, Alaska and Hawaii customers should dial (603) 884-6660. Terms and conditions include net 30 days and F.O.B. DIGITAL plant. Freight charges will be prepaid by DIGITAL and added to the invoice. Minimum order is \$35.00. Minimum does not apply when full payment is submitted with an order. Checks and money orders should be made out to Digital Equipment Corporation.

digital

EK-VT101-UG-003